NRCS Natural Resources Conservation Service

Minnesota

COMPREHENSIVE NUTRIENT MANAGEMENT PLAN

For

Joe Farmer

Address

1234 Shady Lane
Manure Center
Minn. 54000

Directions to farm from the nearest post office

7/5/2006

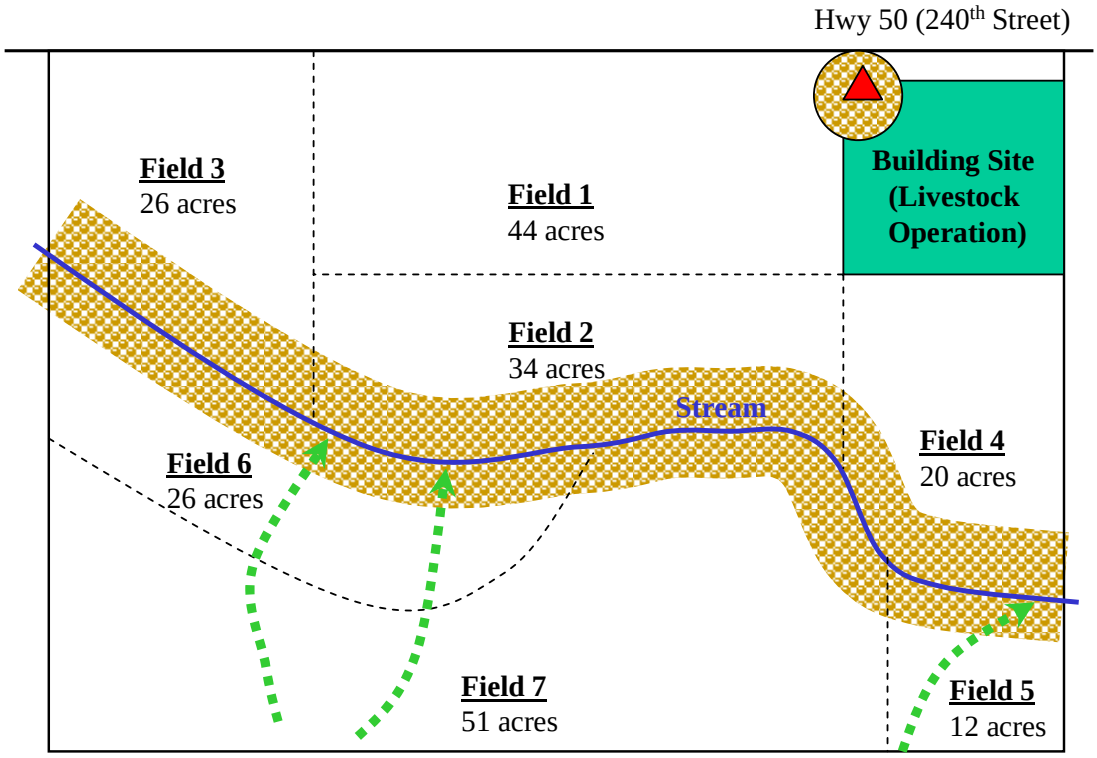
Comprehensive Nutrient Management Plan (CNMP) Table of Contents

THE PLAN

PLANS, ASSESSMENTS AND OTHER INFORMATION

Joe Farmer
Home Farm
(213 tillable acres)
Tract T558

North



Any County
Any Township
Section 14, NW 1/4

Scale: 1 inch = 620 feet

Fields to receive manure applications during rotation(s)
Fields: All

Fields to receive winter-time manure applications during rotation(s)
Fields: None

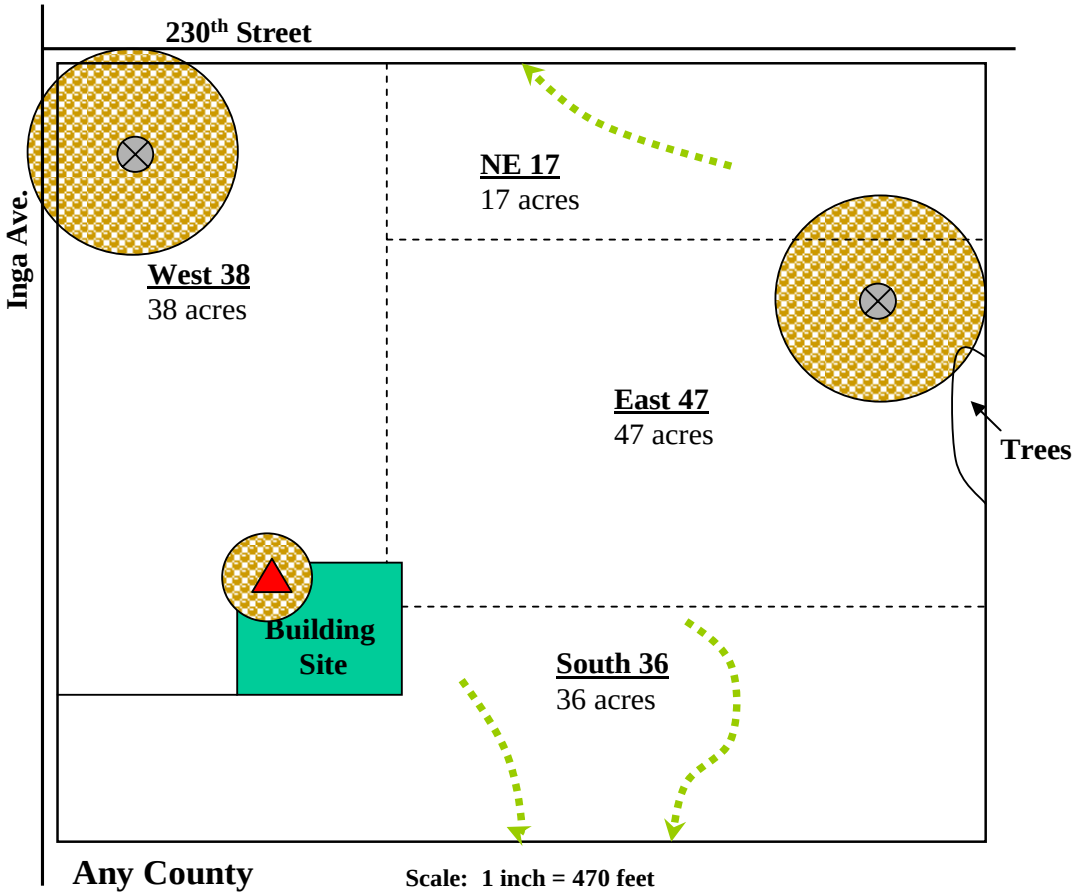
Fields with 6% or greater slopes
Fields: None

Sensitive Areas

- **Stream**
- **Waterway**
- **Tile Inlet**
- **Water Well**
- **Special Protection Area**

Joe Farmer
Raddle Farm
(138 tillable acres)
Tract 978

North



Any County
Any Township
Section 7, NW 1/4

Scale: 1 inch = 470 feet

Fields to receive manure applications during rotation(s)
Fields: All

Fields to receive winter-time manure applications during rotation(s)
Fields: None

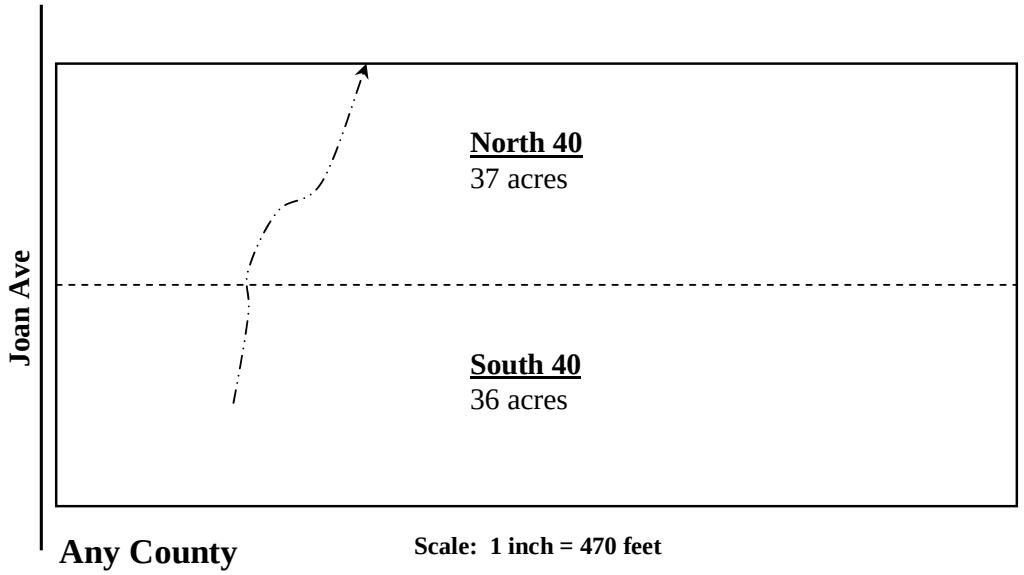
Fields with 6% or greater slopes
Fields: S36

Sensitive Areas

- Stream
- Waterway
- Tile Inlet
- Water Well
- Special Protection Area

North

Joe Farmer
Ricke Farm
(73 tillable acres)
T1157



Any County
Any Township
Section 20, NW 1/4

Scale: 1 inch = 470 feet

Fields to receive manure applications during rotation(s)
Fields: All

Fields to receive winter-time manure applications during rotation(s)
Fields: None

Fields with 6% or greater slopes
Fields: None

Sensitive Areas

- **Stream**
- **Waterway**
- **Tile Inlet**
- **Water Well**
- **Special Protection Area**

COMPREHENSIVE NUTRIENT MANAGEMENT PLAN (CNMP)

(Meets Requirements of USDA-NRCS Programs in Minnesota)

for

Joe Farmer

This CNMP was developed to improve overall ability to safely handle and apply manure at needed rates and to satisfy EQIP requirements. The plan provides recommendations for storage, treatment, and/or transfer of manure, other animal byproducts and livestock mortalities; identifies areas sensitive to manure applications and practices to use in those areas; and provides additional operation and maintenance guidance. General nutrient rate recommendations are also provided. The rates will need adjusting when subsequent annual field specific nutrient plans are developed. This CNMP was developed based on the current crop and animal production practices of the farm operation. Changes in those production practices could result in a need to modify or update this plan.

I. LIVESTOCK; MANURE STORAGE, HANDLING AND TESTING

Appendices 1 and 3 contain reports detailing your livestock type(s) and numbers; the quantity of manure produced annually by those livestock; your current or planned storage systems; and your manure testing practices, spreader calibration procedures and application methods. Following are your existing or planned system components:

Component	Install Year	Component	Install Year
Pit under building	2000		
Pit under building	2002		
Mortalilty Facility	2005		

II. ROTATION, AVAILABLE CROPLAND ACRES, TOTAL NUTRIENTS FROM LIVESTOCK AND ACRES NEEDED TO UTILIZE THOSE NUTRIENTS

This CNMP was developed for your operations' 424 acres in a rotation of corn/soybeans.
Appendix 3's "Nutrient Summary" report indicates that the total nutrients available to plants in the year of application from a year's supply of manure are:

N 29900 lbs.	P_2O_5 23500 lbs.	K_2O 19150 lbs.

and that the following acres are needed to utilize these nutrients:

N 200 acres	P_2O_5 490 acres	K_2O 470 acres

The available nutrient estimates account for nutrient losses in storage and during application. The acreage estimates for N assume that manure is applied to legumes to satisfy removal rates and to non-legumes to satisfy Univ. of Minnesota recommended crop nutrient requirements . You will need more acres than indicated to utilize manure N if you limit manure applications on legume crops.

III. FIELDS WITH SENSITVE AREAS REQUIRING SPECIAL MANAGEMENT

Sensitive Features and Areas

Your fields may contain sensitive features and/or areas requiring special management to keep fertilizer or manure in the zone of application. These often natural features increase the potential for pathogenic organisms or applied nitrogen and phosphorus to move towards ground water or surface waters. Elevated levels of nitrogen in drinking water can be dangerous to babies and young livestock. Scientific trials show direct relationships between soluble algal available phosphorus in runoff and soil test phosphorus (STP) levels. Potential to accelerate algae growth increases as STP levels increase if a field's runoff reaches surface waters.

The following sensitive features occur on one or more of your fields. Appendix 2 contains one or more reports that identify specific fields containing these sensitive features.

High to very high Soil Test P	Soil feature limitations	Steep Slopes	Lake, Stream Wetland <300'	Water-way, Ditch or ephemeral erosion	Open Tile Intake <300'	Sinkhole, well, mine or quarry	Public Water Supply Mgt. area
☒	☒	☒	☒	☒	☒	☒	☐

Additionally the ability for nitrogen to move off-site on this farm has been evaluated based on timing of commercial fertilizer nitrogen applications, soil textures and other f actors. **Field specific loss ratings are found in Appendix 3's "Field Nitrogen Loss Assessment" report**.

The ability for phosphorus to move off-site on this farm has been determined based on soil loss levels, distance to receiving waters and other factors. **Field specific phosphorus loss information is also found in Appendix 3.**

IV. RECOMMENDED PRACTICES FOR SENSITIVE AREAS AND FEATURES

Land Treatment Practices

The following practices are recommended on sensitive fields receiving nutrient applications. Soil and water conservation practices have not been recommended that keep soil losses at 2-4 tons/acre/year thus allowing for more manure application flexibility. **Animals from CAFO lots must be excluded from waters of the state. Animals from AFO lots must also be excluded from most state waters.**

PRACTICE	FIELDS	INSTALL YEAR
Residue Management	**1,4,7, South 36, North 40, South 40**	**2001**
Filter Strip	2,4	2004

Consult your Soil and Water Conservation Plan for additional detail.

Nutrient Management in Sensitive Areas

Consult Appendix 3's Management Practices section for guidance on sensitive area practices.

Winter-time Manure Applications

Fields included in this plan **will not** be receiving wintertime manure applications to frozen or snow-covered surfaces and **are not** identified on the attached aerial photos or maps. Use fields that are the furthest distance from surface water if winter time applications are necessary. *Do not apply manure on actively thawing surfaces. Do not winter apply solid manure on fields with greater than 4 tons/acre/year soil losses. Do not winter apply liquid manure applications on fields with greater than 2 tons/acre/year soil losses*. If this is a CAFO, do not winter-apply liquid manure on fields with greater than 2% slope and do not winter apply solid manure on fields with greater that 6% slope (except with permission from the Minnesota Pollution Control Agency (MPCA)).

June, July or August Manure Applications to Bare, Harvested Fields

Operations where manure management plans are required by state law must plant a cover crop for the remainder of the season on bare fields receiving summertime manure applications. The following cover crops will be established on fields receiving summer–time manure applications: None

High Soil Phosphorus Levels

You should manage your operation to avoid excessive build-up of soil test phosphorus (STP). Your CNMP and subsequent annual plans may not recommend manure applications on some fields because of very high STP levels. In general, plan the rate and frequency of manure applications to avoid STP buildup to 75 ppm as Bray P1. Cease

applications before STP levels reach 150 ppm (300 lbs./ac.) as Bray P1. The following manure application frequencies should be implemented as a phosphorus strategy for either building or maintaining or reducing STP levels.

Manure Applications	List of Fields
every four years	1,4
every three years	2, Raddle So. 36
every 2 years	All other fields

If STP levels continue to rise, two final options are available: 1.) find additional acres for manure applications and/or 2.) change feed management to reduce the amount of nutrients excreted by livestock. **"Livestock Ration Self-Assessment" worksheets" and Feed Management Fact Sheets are found in appendix 5 .**

V. DEAD ANIMAL DISPOSAL

Consult Appendix 1 for detail including a mortality disposal plan.

VI. OPERATION AND MAINTENANCE

- The Operation and Maintenance plan for your system's manure storage, treatment, and transfer components should be carefully read, particularly concerning toxic gasses and fumes in confined locations; required fencing around ponds and periodic inspections of system components.
- The storage structure(s) should be emptied at a frequency shown below and as appropriate should be properly agitated prior to pumping to dislodge settled solids from the bottom and insure adequate nutrient mixing. Test manure at the frequency shown below. This frequency can be reduced after three years if analyses show consistent results overtime or between pump-out or scraping periods. Always retest following changes in manure storage and handling, livestock types or livestock feed. Your planned manure testing frequencies are listed in the table below. Collect and handle manure samples according **to Appendix 6's fact sheet MN-NUTR-6.** Have the samples analyzed by a Minnesota Department of Agriculture (MDA) certified laboratory.

Storage Facility Identification	Number of Times and planned months to Empty Per Year	Manure Sampling Frequency
Finishing barn 1	2 Apr. Nov.	Semi-annually
Finishing barn 2	1 Apr.	Annually

- Sample and analyze soils according to Appendix 6's guidelines (USDA-NRCS-MN Fact Sheet MN-NUTR3 Soil Sampling). Testing for residual soil nitrate should be done annually where appropriate. Sampling and testing for soil nitrate **are not** being planned as a crop N use strategy for this operation.
- Commercial fertilizer and manure application equipment should be cleaned after applications and maintained and calibrated according to manufacturer directions and MN. Dept. of Agriculture and Univ. of Minn. guidelines Equipment will be maintained to insure that applied rates do not deviate from planned rates by more than approximately 15%.
- Apply manure in a uniform pattern that delivers the specified amount across the entirety of the planned area. Application method and incorporation timing will also be uniform across the planning area.
- Use safety practices to minimize exposure to manure gases and organic wastes and chemical fertilizers-particularly ammonia forms of fertilizers. Wear protective clothing including footwear, a respirator, and gloves when appropriate. Consult the MN. Dept. of Agriculture web-site for additional detail.
- Protect fertilizer storage areas from weather to minimize runoff, leakage, and loss of material.
- Consider identifying fields (areas) for emergency wintertime or growing-season manure applications.
- Abandoned lots and storage structures should be closed according to NRCS and state law requirements

VII EMERGENCY RESPONSE PLAN

- **Review Appendix 1's EMERGENCY RESPONSE PLAN** developed as a contingency for a storage facility spill, leak or failure or in the event of spill while transporting or applying manure to your fields.

VIII RECORD KEEPING

Maintain records for a six-year period. **Sample record keeping forms are found in appendix 4.**

Farm specific records

- Quantity of manure and other organic by-products produced.
- Dates and amount of manure removed from the system due to feeding, energy production, or export from the operation.
- Carcass disposal techniques
- Quantity and location of manure transported off-site to land not owned or controlled by you.

Field specific records

- Name and address of commercial hauler or applicator receiving manure.
- Crop yields, planting and harvest dates and crop residues removed.
- Type and analyses of nutrients applied to each field (commercial fertilizer, manure, other nutrient source). Application dates and rates, including application methods and time to incorporation.

IX. NUTRIENT MANAGEMENT PLANS

Appendix 3's Generic Crop Nutrient Management Plan recommends manure and fertilizer application methods, timing and rates. The recommendations take into consideration potential for loss of nitrogen and/or phosphorus to air, runoff and leaching and are based on realistic yield goals, soil tests, manure analyses (average values if not available) and University of Minnesota fertilizer guidelines.

The recommendations are for each crop in your rotation; are grouped by similar fields and are only guides to help develop field specific annual nutrient management plans. Two recommendations may appear per crop: one assuming only commercial fertilizer is used on fields and one assuming manure is used. The recommendations are not valid if any of the following occur: 1.) Manure or soil analyses change, 2.) Application equipment is not regularly calibrated and 3.) Application rate and method is not uniform (more manure is applied in one part of a target area than in another part even though the same rate is recommended for the entire area).

Annual field specific crop nutrient management plans should be developed after manure from existing and/or newly constructed storage structures has been analyzed. Field specific plans capture variability across the farm and are based on your newest manure and soil test results and crop management decisions.

This plan complies with USDA-Natural Resources Conservation Service in Minnesota standards. Additional practices may be necessary to comply with applicable federal, state or local regulations.		
Certified Manure and Wastewater Handling and Storage Specialist _____	***TSP ID # or agency staff title*** _____	
Signature	***Date*** _____	***Phone #*** _____
Certified Nutrient Specialist _____	***TSP ID # or agency staff title*** _____	
Signature	***Date*** _____	***Phone #*** _____
Certified Land Treatment Specialist _____	***TSP ID # or agency staff title*** _____	
Signature	***Date***	***Phone #*** _____
Certified Conservation Planner/Plan Approver _____	***TSP ID # or agency staff title*** _____	
Signature	***Date*** _____	***Phone #*** _____
Owner/Operator Signature	***Date***	

Manure and Wastewater Handling and Storage APPENDIX 1	
Manure and Wastewater Handling and Storage Facility Recommendations	
Recommendations	☒
Manure and Wastewater Handling and Storage Facility Assessment	
1. Facility Description[1]	☒
2. Surface Water Pollution Assessment[1]	☒
3. Odor Assessment[1]	☒
4. Storage Facility Assessment[1]	☒
5. Ground Water Pollution Potential[1]	☒
6. Milk Parlor Wastewater Disposal (if applicable)[1]	☐
7. Silage Leahate Disposal (if applicable)[1]	☒
8. Mortality Disposal[1]	☒
9. Safety Issues[1]	☒
10. Emergency Response[1]	☒
Operation and Maintenance Plan	
O&M Plan and/ or	☐
MPCA O&M Plan	☒
Emergency Response Plan (ERP)	
Include Emergency Response Plan. (Generic ERP)[2] or analogous NRCS hard copy or analogous MPCA Emergency Response Plan	☒
Mortality Disposal Plan	
Animal Mortality Worksheets[2] or analogous NRCS hard copy[1]	
Animal Carcass Disposal Best Management Practices[2] or analogous NRCS hard copy[1]	☐
MPCA Mortality Plan	☒
Odor Management Plan	
MPCA Odor Management Plan for CAFOs (if needed)	☐
Engineering Plans	
Engineering plans prepared for Manure and Wastewater Handling facilities or location of plans	☐
[1] These assessments are located in the NRCS/SWCD copy of your CNMP if you do not want hard copies at this time.	
[2] These reports are from "Nutrient Management Planner for Minnesota" software	

MN MANURE AND WASTEWATER HANDLING AND STORAGE RECOMMENDATIONS AND ASSESSMENT FOR CNMP'S

Prepared By: An Engineer Date: Any Date

Title: Area Engineer

RECOMMENDATIONS

There are no surface or ground water pollution problems associated with the facility identified, although the burial pit may become a problem over time. Concrete manure storage tanks are relatively new and appear to be in good shape. Storage volume is adequate.

The 91% annoyance free factor for odors at the neighbor's property to the south may be a problem. Use of biofilters on the pit fans would increase that factor to 98% annoyance free.

1. Recommend a mortality composting facility be constructed.
2. Recommend biofilters for pit fans.
3. Recommend that the pit access points be posted with confined space warning signs and locked.
4. A confined space emergency should be addressed in the Emergency Response Plan (ERP).

ASSESSMENT

I. Facility Description

Producer: Joe Farmer_____ **County**: Any_

Facility Location: T 21 N, R 3 W, Section 14

Pristine Creek____TWP

Type of Facility: Beef ☐ Other _____

Dairy ☐ Horse ☐

Swine ☒

MPCA Feedlot Permit Yes ☒ No ☐

For Dairy: **Milk Production Rolling Herd Average** _____ lbs/cow/yr

Animals:

Group #	Type	Number	Ave Weight	AU
1	Swine Finishers	1600	100	208

Estimated Required Volume: 643,200 gal._____
(see worksheet)

Buildings and Lots: (attach Photo)

Bldg/Feedlot Name	Type (Size)	Bedding	Animal Group #	Storage ID
1	Finishers	N/A		Pit 1
2	Finishers	N/A		Pit 2

Existing Storage: Yes ☒ No ☐

Geologic Setting: Soil Map Unit: 39 B Wadena_____

Current Manure Handling: Frequency: 12 Monthes_____

When applied: _Fall_____

Type		Incorporated	Injected
Custom Applicator	☒	_____	☒
Tanker	☐	_____	☐
Spreader	☐	_____	☐
Irrigation	☐	_____	☐

II. Surface Water Assessment

Current FLEVAL Rating (Include Sketch): N/A All animals are housed

Surface Water Pollution Potential Description: (include sketch)

No pollution potential to surface water from the facility

III. Odor Assessment

Location of nearest neighbor(s): 1/4 mile to the south
Past Complaints (# and time): 2 complaints last summer and once during agitation /pumping
Potential Odor Sources: Pit Fans
Offset Model Results (if computed): 91 % Annoyance Free. Addition of biofiliters on pit fans would increase rating to 98% Annoyance free for neighbor to the south.

IV. Existing Storage

ID	Type	Size	Period	Condition	Animal Group #
1	Deep Pit	350,000 gallons	1 yr	Excellent	
2	Deep Pit	350,000 gallons	1 yr	Excellent	

Estimated Available Storage: (See Attached Worksheet)
700,000 gallons

V. Ground Water Pollution Potential

Well Location: 200 feet east of building # 1

Geologic Formations: Silt loam soil underlain by glacial till

Water Test Results (from land owner): Producer's well is 150 feet deep and water test show no sign of excess nitrates or bacteria.

Existing Storage Liner Condition: Concrete pits constructed in 2001 and 2002. No cracks larger than hairline cracks observed.

Other significant items: _____

_____

VI. Milk Parlor Wash Water Disposal

Current Disposal: N/A_____

Estimated Volume: N/A_____

VII. Silage Leachate Disposal

Silage Bunks on Site: Yes ☐ No ☒

Bunks Covered: Yes ☐ No ☐

Type of Silage; _____

Evidence of Seepage: _____

Other Comments: _____

VIII. Mortality Disposal

Current disposal system: Rendering ☐ Burial ☒

Composting ☐ Incineration ☐

Other _____

Number of mortalities per year: 10_____

Onsite observation: Burial pit used. Pit dug in silt loam soil, occasionally ponds water. Producer willing to change to compost system.

IX. Safety Issues

Confined Spaces: Yes ☒ No ☐

Warning Signs: Yes ☐ No ☒ N/A ☐

Safety Fence: Yes ☒ No ☐ N/A ☐

Other: Recommend that producer post warning sign by pit access points and lock access covers.

X. Emergency Response Plan (ERP)

Landowner has one prepared: Yes ☒ No ☐

Recommendations to existing: Confined space hazard should be noted in O&M plan.

Provide Standard ERP Template: Yes ☒ No ☐

Operation and Maintenance Plan

This Operation and Maintenance Plan is incorporated into the General NPDES/SDS Permit by reference and made an enforceable part of the Permit.

Facility Name: Joe's Swine Finishing Building **Owner/Operator Name:** Joe Farmer

Facility Location: Section **14** 21 N. R3W Township, Pristine Creek County **Registration Number:** _____

County Contact: Name: _____ Phone: _____ **Regional MPCA Office Phone Number:** _____

Listing of Manure Handling and Storage Areas/Operation and Maintenance Practices

Manure Handling or Storage Area	Description	Best Management Practices/Technologies (see list below)
(Example) Manure Storage	*200' x 300' x 17' earthen basin*	*1,2,3,4,5,6,7,8,9,10,12,13,14,15,16,17,18,20,21,23*
Manure Storage1	Under building Pit1	4,6,8,9,18,21,22
Manure Storage2	Under building Pit 2	

Activities Required by Permit Conditions

1. Perform weekly visual inspection of stormwater diversion devices
2. Perform weekly visual inspections of runoff control structures
3. Perform weekly visual inspections of devices channeling manure-contaminated runoff to the manure storage or containment structure
4. Perform weekly visual inspections of all liquid manure storage areas (LMSAs)
5. Read depth marker levels for all LMSAs collecting precipitation
6. Maintain design freeboard in LMSAs
7. For LMSAs with a perimeter drain tile, examine weekly the monitoring port or drain tile outlet for water flow and signs of discoloration or odor in any water flowing in the drain tile
8. Inspect all water lines daily, including drinking and cooling water lines
9. Inspect manure hauling equipment periodically for leaks

Facility Design, Maintenance, and Operational Practices

10. Repair sloughing or settling of earthen embankments
11. Repair of damage to concrete, lumber, steel, or other construction material used
12. Control vegetation around LMSAs by frequent mowing or other practices
13. Use access pads for pump-out equipment to prevent erosion
14. Use anti-scour practices at pipe outlets to prevent liner damage
15. Maintain appropriate design volume in LMSAs by controlling sludge build up.
16. Divert surface water flow away from manure storage areas
17. Prevent surface waters from pooling near manure storage areas
18. Routine maintenance of equipment such as valves and pumps
19. Removal of built up solids from separation screens
20. Maintain a fence around LMSAs
21. Check hoses and couplings frequently during pumping for leaks
22. Use automatic shut-off devices on continuous pumping equipment
23. Cleaning out of transfer pipes to prevent sludge build up
24. Maintain minimum thickness of floor/pad

Other

25. Other: Lock Pit Access Points and post with warning signs
26. Other: _____
27. Other: _____

Type of Manure Storage Area	Best Management Practices (from list on page one)																							
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
Manure Storage Basin with Soil Liner	R	R	R	R	R	R	R	R	R	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Manure Storage Basin with Synthetic Liner	R	R	R	R	R	R	R	R	R	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Manure Storage Basin with Soil, Concrete, and/or Synthetic Liner	R	R	R	R	R	R	R	R	R	X	X	X	X	X	X	X	X	X	X	X	X	X	X	
Below Barn Concrete Pit	R	R	R	R	R	R	R	R	R		X				X	X	X	X			X	X	X	
Concrete Pit or Tank Located Outside of Barn	R	R	R	R	R	R	R	R	R		X				X	X	X	X		X	X	X	X	
Steel-lined Above Ground Tank	R	R	R	R	R	R	R	R	R		X				X	X	X	X			X	X	X	
Manure Stacking Structures	R	R	R	R	R	R	R	R	R	X	X	X	X			X	X	X	X	X			X	
Compost Areas	R	R	R					R	R		X					X	X	X						X
Permanent Stockpile	R	R	R					R	R		X					X	X							
Short-term Stockpile	R	R	R					R	R	X						X	X							X

This chart indicates best management practices that may be associated with common types of manure storage areas. "R" is used for those practices required to be included in the Operation and Maintenance Plan. "X" is for other practices that may be used, but are not specifically required.

Feedlot Registration No. _____

Emergency Response Plan

In Case of an Emergency Spill, Leak, or Failure at the Production Facility or Land Application Area

Farm/Name: Home Farm **Owner:** Joe Farmer **Operator:** Same

Location: E911# S88476 So Side of Highway 50, 7.3 miles east of Manure Center, Minn.

NE ¼ of the NW ¼, Section 14, 21 N, 3W (Pristine Creek) Township, Any County

1. Immediately stop all other activities and implement the following initial containment steps:

- Immediately stop the source of the leak or spill to prevent the spill from getting bigger.
  - For example, turn off all pumps/valves and clamp hoses or park tractor on hoses.
- Make necessary phone calls as listed in the chart below:
  - Notify the Minnesota Duty Officer at **1-800-422-0798** within 24 hours or immediately if there is any potential to pollute surface water or ground water and assistance is needed.
  - Call sheriff's office if spilled on public roads or its right-of-ways for traffic control. Clean the spill immediately from the road and roadside.
- Contain the spill and prevent spill from entering tile intakes or surface waters, for example:
  - Use skid loader or tractor with blade to make berms.
  - Insert sleeves around tile intakes (or plug/cap intakes) and block downslope culverts.
  - Use tillage implements to work up the ground ahead of the spill or use absorptive materials.

2. Phone numbers to call:

	Contact Person (or Company)	Phone Number
Equipment and Supplies		
• Earth Moving Equipment		( )
• Manure Pumper		( )
• Containment Materials		( )
• Tile Equipment/Other Supplies		( )
•		( )
Emergency Contacts		
• Fire Department	----------	( )
• Emergency	----------	( )
Other Notifications		
• Minnesota Duty Officer	----------	**1-800-422-0798**
• County Sheriff's Office	----------	( )
• County Health Department		( )
• MPCA or County Feedlot Officer		( )
•		( )

- Provide the following information when contacting the Minnesota Duty Officer:
  - Your name, phone number, farm name, and address.
  - Spill location, date, and time.
  - Type and volume of material that spilled.
  - Has manure reached surface waters or field drains? If so, what is the name of the impacted water?
  - What is currently in progress to contain the spilled material?

3. Cleanup

- Clean up all the material, including contaminated soil, as soon as possible by pumping, scraping, or by other means.
- Pump the contained manure for application onto cropland at agronomic rates.
- Follow recommendations of the County Feedlot Officer and/or MPCA staff.
- Restore the site to its original condition. Remove contaminated soils, replant disturbed areas, etc.

4. Document your actions

- Keep records of all actions related to the spill and follow-up activities.

Animal Mortality Plan

Handling Dead Animals in Accordance with State Requirements Including: Minn. Stat. § 35.82 and Minn. R. chs. 1719.0100 to 1719.4600 and 7011.1215

Farm/Name: **Home Farm** **Feedlot Registration Number:** _____

Owner: Joe Farmer **Operator:** _____

Location: Section _____ , _____ Township, _____ County

Planned Method of Animal Disposal: For each animal type, indicate dead animal handling method(s) to be used at your feedlot. The minimum requirements for each management option are described on the following page. Please make sure locations of burial sites, incinerators, temporary mortality storage, and/or compost areas are indicated on the map of your facility included with the NPDES/SDS permit application.

Animal Type	Bury	Incinerate	Render	Compost	Other
Swine	☐	☐	☐	☒	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐
	☐	☐	☐	☐	☐

If other, explain: _____

Legal Methods of Disposal:

SPECIES	METHOD				
	Bury	Incinerate	Render	Compost	Exempt by Law
Poultry	☑	☑	☑	☑	☐
Swine	☑	☑	☑	☑	☐
Cattle	☑	☑	☑	☐*	☐
Horses	☑	☑	☑	☐*	☐
Sheep / Goats	☑	☑	☑	☑	☐
Household Pets	☐	☐	☐	☐	☑
Wild Animals	☐	☐	☐	☐	☑
Game Farm / Exotic Animals	☑	☑	☑	☐*	☐

*If composting cattle, horses, or game/exotic animals, contact the Minnesota Board of Animal Health at (651) 296-2942 or (800) 627-3529.

Animal carcasses should be disposed of as soon as possible, within 48-72 hours. Any vehicles transporting carcasses must be: leak proof, covered, inspected, and permitted by the Minnesota Board of Animal Health (except if owner is transporting his own dead animals).

Bury

Operators choosing to bury animals must select sites very carefully due to the high risk of ground-water contamination. Buried carcasses must:

- Stay five (5) feet above seasonal high water table;
- Stay away from lakes, rivers, streams, ditches, etc.;
- Be covered immediately with enough soil to keep scavengers out (Minnesota Board of Animal Health guidelines indicate three (3) feet is sufficient);
- Not be placed in sandy or gravelly soil types; and
- Maintain at least ten (10) feet vertical separation between dead animals and bedrock.

Compost

The composting process must, at a minimum, meet the following:

- The owner of the compost facility shall have a written protocol for the operation containing at least the minimum steps listed below and instructing all employees to follow the protocol;
- Mortalities must be processed daily;
- A base of litter is required. The carcasses or discarded animal parts and litter plus bulking agent are added in layers so that the carbon to nitrogen ratio is in the range of 15:1 to 35:1 (optimal 23:1);
- The carcasses or discarded animal parts must be kept six (6) inches from the edges and sealed with litter each day;
- The temperature must be taken and recorded on site daily. The compost temperature must reach a minimum of 130 degrees Fahrenheit. Approximately seven (7) to ten (10) days are needed in each heat cycle to process the carcasses and kill the pathogens. The temperature drop indicates the time to mix and move the compost. A minimum of two (2) heat cycles is required; and
- The finished compost must not contain visible pieces of soft tissue and must be handled, stored, and used according to all other applicable rules.

In addition, composting facilities must be:

- Built on an impervious[*], weight-bearing pad that is large enough to allow equipment to maneuver;
- Covered with a roof to prevent excessive moisture on the composting material, but if sawdust or other water-repelling material is used as the bulking agent, a roof may not be necessary;
- Built of rot-resistant material that is strong enough to withstand the force exerted by equipment; and
- Large enough to handle each day's normal mortality through the endpoint of the composting which consists of a minimum of two (2) heat cycles.

Incinerate

Incinerator must be:

- Capable of producing emissions not to exceed 20 percent opacity;
- Fitted with an afterburner that maintains flue gases at 1,200 degrees Fahrenheit for at least 0.3 seconds; and
- Ash from the incinerator must be handled in such a manner as to prevent particulate matter from becoming airborne.

In addition, it is recommended that the incinerator is large enough to handle each day's mortalities.

Render

Carcasses left at an off-site pickup point must be:

- Kept in an animal-proof, enclosed area;
- At least 200 yards from a neighbor's buildings;
- Picked up within 72 hours;
- If the enclosed area is refrigerated to less than 45 degrees Fahrenheit, the carcasses must be picked up within seven (7) days.

Alternative Methods

Alternative methods of mortality disposal including, but not limited to, pet food processing, fur farm consumption, lactic fermentation, extrusion, and experimental composting, require a permit from the Minnesota Board of Animal Health. For more information on alternative methods of carcass disposal, contact the Board of Animal Health at (651) 296-2942.

[*] For the purpose of compost pad construction, Class V gravel material is not considered to be impervious.

Land Treatment APPENDIX 2

Management Practices		
Recommended Soil and Water Conservation Practices or	☐	
Provide location of recommendations In your Conservation Plan	☒	
General Information		
Soil Maps and Soil Legends or Location Redwood County Soil and Water Conservation District Case File	☐	
"General Farm Field Information" or equivalent information. Equivalents means fields, field names, acres, irrigated or non-inirrigated and location (County, Township, Section)	☒	
Evaluations		
Field Specific Sheet and Rill Soil Loss Estimates Or	☐	
Provide location of estimates Redwood County Soil and Water Conservation District Case File	☒	
Sensitive Area Determinations. NRCS form MN-CPA-40 (Farming Practices Inventory) or equivalent or 'Management Practice Considerations in Sensitive Fields Report'[1] or equivalent MPCA form or equivalent.	☒	
1. This report is from "Nutrient Management Planner for Minnesota" software		

Operator/Producer Joe Farmer **Planning Year** 2002 **Date Printed** Jan 29, 2002

General Farm Field Information

Field	Acres	Irrigated	Location/Description
Home T558			
1	44.0		Dakota County, Hampton Twp, Section 14, NW1/4
2	34.0		Hampton Twp, Section 14, NW 1/4
3	26.0		Hampton Twp, Section 14, NW1/4
4	20.0		Hampton Twp, Section 14, NE 1/4
5	12.0		Hampton Twp, Section 14, NE 1/4
6	26.0		Hampton Twp, Section 14, NW 1/4
7	51.0		Hampton Twp, Section 14, NW 1/4
Raddle T978			
East 47	47.0		Dakota County, Douglas Twp, Section 7, NW 1/4
NE 17	17.0		Douglas Twp, Section 7, NW 1/4
South 36	36.0		Douglas Twp, Section 7, NW 1/4
West 38	38.0		Douglas Twp, Section 7, NW 1/4
Ricke T1157			
North 40	36.0		Dakota County, Douglas Twp, Section 20, NW 1/4
South 40	37.0		Douglas Twp, Section 20, NW 1/4
Total Acres	**424.0**		

Operator/Producer Joe Farmer **Planning Year** 2002 **Date Printed** Jan 29, 2002

Management Practice Considerations in Sensitive Fields

Farm/Field	Sensitive Features and Conditions	Management Practices
Home T558		
1	Road ditches	Do not apply manure directly into road ditches (MN State Requirement)
2	Surface water within 300 feet No effective filter strip Soil phosphorus test levels 21-75 ppm (Bray) or 16-60 ppm (Olsen) Sheet and rill soil losses <= 6 tons/acre/year	Do not apply manure within 25 feet of surface water (MN State Requirement) Inject or incorporate manure within 24 hours if applied within 300 feet of surface water (MN State Requirement) Do not apply manure within 300 feet of surface water when soils are frozen or snow-covered or actively thawing (winter) (MN State Requirement) Base manure applications on P2O5 removal (MN State Requirement) Do not apply commercial nitrogen or phosphorous fertilizer when soils are frozen or snow-covered or actively thawing (winter) (NRCS-MN Program Requirement) Installation of appropriate filter strip next to surface water is encouraged
3	Surface water within 300 feet No effective filter strip Soil phosphorus test levels <21 ppm (Bray) or < 16 ppm (Olsen) Sheet and rill soil losses <= 6 tons/acre/year Road ditches	Do not apply manure within 25 feet of surface water (MN State Requirement) Inject or incorporate manure within 24 hours if applied within 300 feet of surface water (MN State Requirement) Do not apply manure within 300 feet of surface water when soils are frozen or snow-covered or actively thawing (winter) (MN State Requirement) Do not apply manure directly into road ditches (MN State Requirement) Do not apply commercial nitrogen or phosphorous fertilizer when soils are frozen or snow-covered or actively thawing (winter) (NRCS-MN Program Requirement) Installation of appropriate filter strip next to surface water is encouraged

Management Practice Considerations in Sensitive Fields

Farm/Field	Sensitive Features and Conditions	Management Practices
4	Surface water within 300 feet No effective filter strip Soil phosphorus test levels 76-150 ppm (Bray) or 61-120 ppm (Olsen) Sheet and rill soil losses < 4 tons/acre/year	Do not apply manure within 25 feet of surface water (MN State Requirement) Inject or incorporate manure within 24 hours if applied within 300 feet of surface water (MN State Requirement) Do not apply manure within 300 feet of surface water when soils are frozen or snow-covered or actively thawing (winter) (MN State Requirement) Base manure applications on P2O5 removal (MN State Requirement) If applying manure from an operation with more than 300 animal units, the owner must apply for an interim permit and submit a manure management plan that includes phosphorous management to minimize risk to surface water. (MN State Requirement) Do not apply commercial nitrogen or phosphorous fertilizer when soils are frozen or snow-covered or actively thawing (winter) (NRCS-MN Program Requirement) Installation of appropriate filter strip next to surface water is encouraged
5	Surface water within 300 feet No effective filter strip Soil phosphorus test levels <21 ppm (Bray) or < 16 ppm (Olsen) Sheet and rill soil losses <= 6 tons/acre/year Established waterways, ditches and other water conveyances	Do not apply manure within 25 feet of surface water (MN State Requirement) Inject or incorporate manure within 24 hours if applied within 300 feet of surface water (MN State Requirement) Do not apply manure within 300 feet of surface water when soils are frozen or snow-covered or actively thawing (winter) (MN State Requirement) Do not apply manure directly into waterway, ditch or other water conveyance system (NRCS-MN Program Requirement) Do not apply commercial nitrogen or phosphorous fertilizer when soils are frozen or snow-covered or actively thawing (winter) (NRCS-MN Program Requirement) Installation of appropriate filter strip next to surface water is encouraged

Management Practice Considerations in Sensitive Fields

Farm/Field	Sensitive Features and Conditions	Management Practices
6	Surface water within 300 feet	Do not apply manure within 25 feet of surface water (MN State Requirement)
	No effective filter strip	Inject or incorporate manure within 24 hours if applied within 300 feet of surface water (MN State Requirement)
	Soil phosphorus test levels <21 ppm (Bray) or < 16 ppm (Olsen)	Do not apply manure within 300 feet of surface water when soils are frozen or snow-covered or actively thawing (winter) (MN State Requirement)
	Sheet and rill soil losses <= 6 tons/acre/year	Do not apply manure directly into waterway, ditch or other water conveyance system (NRCS-MN Program Requirement)
	Established waterways, ditches and other water conveyances	Do not apply commercial nitrogen or phosphorous fertilizer when soils are frozen or snow-covered or actively thawing (winter) (NRCS-MN Program Requirement)
		Installation of appropriate filter strip next to surface water is encouraged
7	Surface water within 300 feet	Do not apply manure within 25 feet of surface water (MN State Requirement)
	No effective filter strip	Inject or incorporate manure within 24 hours if applied within 300 feet of surface water (MN State Requirement)
	Soil phosphorus test levels <21 ppm (Bray) or < 16 ppm (Olsen)	Do not apply manure within 300 feet of surface water when soils are frozen or snow-covered or actively thawing (winter) (MN State Requirement)
	Sheet and rill soil losses <= 6 tons/acre/year	Do not apply manure directly into waterway, ditch or other water conveyance system (NRCS-MN Program Requirement)
	Established waterways, ditches and other water conveyances	Do not apply commercial nitrogen or phosphorous fertilizer when soils are frozen or snow-covered or actively thawing (winter) (NRCS-MN Program Requirement)
		Installation of appropriate filter strip next to surface water is encouraged

Management Practice Considerations in Sensitive Fields

Farm/Field	Sensitive Features and Conditions	Management Practices
Raddle T978		
East 47	Open (Surface) tile intakes	Do not apply manure within 300 feet open tile inlets when soils are frozen or snow-covered or actively thawing (winter) (MN State Requirement) Within 300 feet of open tile inlets, inject or incorporate manure within 24 hours (MN State Requirement)
NE 17	Road ditches	Do not apply manure directly into road ditches (MN State Requirement)
	Established waterways, ditches and other water conveyances	Do not apply manure directly into waterway, ditch or other water conveyance system (NRCS-MN Program Requirement)
South 36	Road ditches	Do not apply manure directly into road ditches (MN State Requirement)
	Established waterways, ditches and other water conveyances	Do not apply manure directly into waterway, ditch or other water conveyance system (NRCS-MN Program Requirement)
West 38	Open (Surface) tile intakes	Do not apply manure within 300 feet open tile inlets when soils are frozen or snow-covered or actively thawing (winter) (MN State Requirement)
	Road ditches	Within 300 feet of open tile inlets, inject or incorporate manure within 24 hours (MN State Requirement) Do not apply manure directly into road ditches (MN State Requirement)

Management Practice Considerations in Sensitive Fields

Farm/Field	Sensitive Features and Conditions	Management Practices
Ricke T1157		
North 40	Road ditches	Do not apply manure directly into road ditches (MN State Requirement)
	Established waterways, ditches and other water conveyances	Do not apply manure directly into waterway, ditch or other water conveyance system (NRCS-MN Program Requirement)
	Coarse textured soils	In fall, delay manure applications until daily average soil temperatures at a 6 inch depth are below 50 degrees F. (NRCS-MN Program Requirement)
		In fall, avoid liquid manure applications when possible
		In fall, do not apply commercial nitrogen fertilizer (NRCS-MN Program Requirement)
		Use sidedress or split applications of commercial nitrogen fertilizer
South 40	Road ditches	Do not apply manure directly into road ditches (MN State Requirement)
	Established waterways, ditches and other water conveyances	Do not apply manure directly into waterway, ditch or other water conveyance system (NRCS-MN Program Requirement)
	Coarse textured soils	In fall, delay manure applications until daily average soil temperatures at a 6 inch depth are below 50 degrees F. (NRCS-MN Program Requirement)
		In fall, avoid liquid manure applications when possible
		In fall, do not apply commercial nitrogen fertilizer (NRCS-MN Program Requirement)
		Use sidedress or split applications of commercial nitrogen fertilizer

Nutrient Management APPENDIX 3		
Nutrient Management Plan		
The NRCS form "CNMP Rotational Crop Nutrient Management Budget" or equivalent	☒	
Recommended Management Practices		
"Nutrient Application Restrictions in Sensitive Areas" report[1] or analogous NRCS hard copy or equivalent or	☐	
"Management Practice Considerations in Sensitive Fields" report [1] This is an optional report that can be used in place of the "Nutrient Application Restrictions in Sensitive Areas" Report (Located in Appendix 2)	☒	
"Management Practice Considerations for Nitrogen and Phosphorus" report [1] or analogous NRCS hard copy or equivalent	☒	
MPCA Sensitive areas and Practices Report. Optional and can replace one or more of the above listed reports	☐	
Inventories		
"Crop Information" report [1] or NRCS form MN-CPA-41 (Cropping History and Soil Fertility Inventory) or equivalent[2]	☐	
NRCS form MN-CPA-43 (Nutrient Management Practices Inventory) or equivalent[2]	☐	
"Manure Storage, Handling and Testing" report [1] or NRCS form MN-CPA-42 (Livestock and Manure Information) or equivalent MPCA report or equivalent	☒	
Soil Test Results or provide information in report form such as on MN-CPA-41 or "Soil Information" report[1]	☒	
Manure Test Results for existing facilities or provide information in report form such as MN-CPA-42 or "Manure Storage, Handling and Testing" report [1]	☐	
Evaluations and Computations		
Minimum acres computations. "Nutrient Summary" reports [1] or equivalent	☒	
NRCS Minnesota Field Nitrogen Loss Assessment[1] or analogous NRCS hard copy[2]	☒	
NRCS Minnesota Field Phosphorus Loss Assessment[1] or analogous NRCS hard [2] copy	☒	
Manure Spreader Calibration Worksheets for manure from existing facilities. Updated after new facilities are constructed. [2]	☐	
[1]. **These reports are from "Nutrient Management Planner for Minnesota" software**		
[2] **These assessments are located in the NRCS/SWCD copy of your CNMP if you do not want hard copies at this time.**	☒	

Manure and Wastewater Handling and Storage APPENDIX 1	
Manure and Wastewater Handling and Storage Facility Recommendations	
Recommendations	☐
Manure and Wastewater Handling and Storage Facility Assessment	
1. Facility Description[1]	☐
2. Surface Water Pollution Assessment[1]	☐
3. Odor Assessment[1]	☐
4. Storage Facility Assessment[1]	☐
5. Ground Water Pollution Potential[1]	☐
6. Milk Parlor Wastewater Disposal (if applicable)[1]	☐
7. Silage Leahate Disposal (if applicable)[1]	☐
8. Mortality Disposal[1]	☐
9. Safety Issues[1]	☐
9. Safety Issues[1]	☐
10. Emergency Response[1]	☐
Operation and Maintenance Plan	
O&M Plan and/ or	☐
MPCA O&M Plan	☐
Emergency Response Plan (ERP)	
Include Emergency Response Plan. (Generic ERP)[2] or analogous NRCS hard copy or analogous MPCA Emergency Response Plan	☐
Mortality Disposal Plan	
Animal Mortality Worksheets[2] or analogous NRCS hard copy[1]	
Animal Carcass Disposal Best Management Practices[2] or analogous NRCS hard copy[1]	☐
MPCA Mortality Plan	☐
Odor Management Plan	
MPCA Odor Management Plan for CAFOs (if needed)	☐
Engineering Plans	
Engineering plans prepared for Manure and Wastewater Handling facilities or location of plans	☐
[1] These assessments are located in the NRCS/SWCD copy of your CNMP if you do not want hard copies at this time.	
[2] These reports are from "Nutrient Management Planner for Minnesota" software	

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE 03/06

CNMP ROTATIONAL CROP NUTRIENT MANAGEMENT BUDGETS[1]

PRODUCER JOE FARMER | **CROPPING SCENARIO DESCRIPTION** C/SB

Farm # Home | **Tract #** T558 | **Field #s**[2] 1,4

SOIL INFORMATION[3]

	NO_3-N lbs/acre	P ppm	K ppm	Organic Matter %	pH	
1.		80B	210	3.5	6.6	

CROP NUTRIENT RECOMMENDATIONS

Crop	Corn	Previous Year's Crop	Soybeans	Crop 2 Years Ago	Corn
Realistic Yield Goal	170	Previous Yields	55	Previous Yields	170

University of Minnesota Fertilizer Recommendations

	N*	P_2O_5	K_2O (pounds per acre)	
2.	120	0	0	**Any 1st Year Legume Nitrogen Credits are accounted for in Line 2 Recommendation*

UM Nitrogen Recommendation Used
- ☒ Standard
- ☐ Western MN Soil Nitrate Test (2 ft.)
- ☐ Corn Soil Nitrogen Test (Spring 2ft)**

2ND YEAR NUTRIENT CREDITS

3.	(-)			Legume Nitrogen Credit**
4.	(-)			Manure Nitrogen Credit **
5.	140	0	0	**Net Nutrients Needed**

RECOMMENDED NUTRIENT APPLICATIONS

6. **Manure Applications – 1st Year Nutrient Credits**

N	P2O5	K2O (pounds per acre)	Source	Timing	Method	Rate

7. **Commercial Fertilizer Applications**

N	P2O5	K2O (pounds per acre)	Form/Analysis	Timing	Method	Rate
115	0	0	Urea	Spring pre-plant	Surface Broadcast/incorp.	250 lbs
4	12	4	7-21-7	At planting	Row starter 2X2 placement	5 gal.

8.	119	12	4	**Total Nutrients to be Applied**
9.	-1	+12	+4	**Nutrient Balance**

[1] Develop a budget for each crop in a normal rotation

[2] Group fields by similar soils, soil fertility and past fertility management.

[3] Use a soil test value that is representative of the grouped fields

Plan developed by: | **TSP I.D. #** | **Date:**

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE 03/06

CNMP ROTATIONAL CROP NUTRIENT MANAGEMENT BUDGETS[1]

PRODUCER JOE FARMER | **CROPPING SCENARIO DESCRIPTION** C/SB

Farm # Home | **Tract #** T558 | **Field #s**[2] 2,3,5,6,7

SOIL INFORMATION[3]

	NO_3-N lbs/acre	P ppm	K ppm	Organic Matter %	pH	
1.		17	121	>3	>6.3	

CROP NUTRIENT RECOMMENDATIONS

Crop 170	**Previous Year's Crop** Soybean	**Crop 2 Years Ago** Corn
Realistic Yield Goal 170	**Previous Yields** 50	**Previous Yields** 170

University of Minnesota Fertilizer Recommendations

	N*	P_2O_5	K_2O
	(pounds per acre)		
2.	120	15	25

**Any 1st Year Legume Nitrogen Credits are accounted for in Line 2 Recommendation*

UM Nitrogen Recommendation Used
- ☒ Standard
- ☐ Western MN Soil Nitrate Test (2 ft.)
- ☐ Corn Soil Nitrogen Test (Spring 2ft)**

2ND YEAR NUTRIENT CREDITS

3.	(-)			Legume Nitrogen Credit**
4.	(-)			Manure Nitrogen Credit **
5.				**Net Nutrients Needed**

RECOMMENDED NUTRIENT APPLICATIONS

6. **Manure Applications – 1st Year Nutrient Credits**

N	P2O5	K2O	Source	Timing	Method	Rate
(pounds per acre)						
126	107	98	Bldgs 1&2	Fall	Knife Inject	3800

7. **Commercial Fertilizer Applications**

N	P2O5	K2O	Form/Analysis	Timing	Method	Rate
(pounds per acre)						
4	12	4	7-21-7	At planting	Row starter 2X2 placement	5 Gal.

8.	130	119	102	**Total Nutrients to be Applied**
9.	+10	+114	+77	**Nutrient Balance**

[1] Develop a budget for each crop in a normal rotation

[2] Group fields by similar soils, soil fertility and past fertility management.

[3] Use a soil test value that is representative of the grouped fields

Plan developed by: | **TSP I.D. #** | **Date:**

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE 03/06

CNMP ROTATIONAL CROP NUTRIENT MANAGEMENT BUDGETS[1]

PRODUCER JOE FARMER | **CROPPING SCENARIO DESCRIPTION** C/SBwithmanure

Farm # Raddle | **Tract #** T978 | **Field #s**[2] All

SOIL INFORMATION[3]

	NO_3-N lbs/acre	P ppm	K ppm	Organic Matter %	pH	
1.		17	122	>3.4	6.2	

CROP NUTRIENT RECOMMENDATIONS

Crop	Corn	Previous Year's Crop	Soybeans	Crop 2 Years Ago	Corn
Realistic Yield Goal	170	Previous Yields	55	Previous Yields	170

University of Minnesota Fertilizer Recommendations

	N*	P_2O_5	K_2O
	(pounds per acre)		
2.	120	15	25

**Any 1st Year Legume Nitrogen Credits are accounted for in Line 2 Recommendation*

UM Nitrogen Recommendation Used
- ☒ Standard
- ☐ Western MN Soil Nitrate Test (2 ft.)
- ☐ Corn Soil Nitrogen Test (Spring 2ft)**

2ND YEAR NUTRIENT CREDITS

3.	(-)		Legume Nitrogen Credit**
4.	(-)		Manure Nitrogen Credit **
5.			**Net Nutrients Needed**

RECOMMENDED NUTRIENT APPLICATIONS

6. **Manure Applications – 1st Year Nutrient Credits**

N	P2O5	K2O	Source	Timing	Method	Rate
(pounds per acre)						
138	152	143	Bldg 1	Spring	Broadcast-incorporation within 4 da	5300

7. **Commercial Fertilizer Applications**

N	P2O5	K2O	Form/Analysis	Timing	Method	Rate
(pounds per acre)						
4	12	4	7-21-7	At planting	Row starter 2X2 placement	5 gal.

8.	142	164	147	**Total Nutrients to be Applied**
9.	22	149	122	**Nutrient Balance**

[1] Develop a budget for each crop in a normal rotation

[2] Group fields by similar soils, soil fertility and past fertility management.

[3] Use a soil test value that is representative of the grouped fields

Plan developed by: | **TSP I.D. #** | **Date:**

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE 03/06

CNMP ROTATIONAL CROP NUTRIENT MANAGEMENT BUDGETS[1]

PRODUCER JOE FARMER | **CROPPING SCENARIO DESCRIPTION** C/SBwithoutmanure

Farm # Raddle | **Tract #** T978 | **Field #s**[2] All

SOIL INFORMATION[3]

	NO_3-N lbs/acre	P ppm	K ppm	Organic Matter %	pH	
1.		17	122	>3.4	6.2	

CROP NUTRIENT RECOMMENDATIONS

Crop	Corn	Previous Year's Crop	Soybeans	Crop 2 Years Ago	Corn
Realistic Yield Goal	170	Previous Yields	55	Previous Yields	170

University of Minnesota Fertilizer Recommendations

	N*	P_2O_5	K_2O (pounds per acre)
2.	120	15	25

**Any 1st Year Legume Nitrogen Credits are accounted for in Line 2 Recommendation*

UM Nitrogen Recommendation Used
- ☒ Standard
- ☐ Western MN Soil Nitrate Test (2 ft.)
- ☐ Corn Soil Nitrogen Test (Spring 2ft)**

2ND YEAR NUTRIENT CREDITS

3.	(-)	Legume Nitrogen Credit**
4.	(-)	Manure Nitrogen Credit **
5.		**Net Nutrients Needed**

RECOMMENDED NUTRIENT APPLICATIONS

6.	N	P2O5	K2O (pounds per acre)	Manure Applications – 1st Year Nutrient Credits: Source	Timing	Method	Rate

7.	N	P2O5	K2O (pounds per acre)	Commercial Fertilizer Applications: Form/Analysis	Timing	Method	Rate
	8	24	8	7-21-7	At planting	Row starter 2X2 placement	10 gal.
	115	0	0	Urea	Spring pre-plant	Surface Broadcast/incorp.	250

8.	123	24	8	**Total Nutrients to be Applied**
9.	+3	+9	-17	**Nutrient Balance**

[1] Develop a budget for each crop in a normal rotation

[2] Group fields by similar soils, soil fertility and past fertility management.

[3] Use a soil test value that is representative of the grouped fields

Plan developed by: | **TSP I.D. #** | **Date:**

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE 03/06

CNMP ROTATIONAL CROP NUTRIENT MANAGEMENT BUDGETS[1]

PRODUCER JOE FARMER | **CROPPING SCENARIO DESCRIPTION** C/SB

Farm # Ricke | **Tract #** T1157 | **Field #s**[2] All

SOIL INFORMATION[3]

	NO_3-N lbs/acre	P ppm	K ppm	Organic Matter %	pH	
1.		15	105	<3	6.2	

CROP NUTRIENT RECOMMENDATIONS

Crop	Corn	Previous Year's Crop	Soybeans	Crop 2 Years Ago	Corn
Realistic Yield Goal	170	Previous Yields	55	Previous Yields	170

University of Minnesota Fertilizer Recommendations

	N*	P_2O_5	K_2O
	(pounds per acre)		
2.	150	40	70

**Any 1st Year Legume Nitrogen Credits are accounted for in Line 2 Recommendation*

UM Nitrogen Recommendation Used
- ☒ Standard
- ☐ Western MN Soil Nitrate Test (2 ft.)
- ☐ Corn Soil Nitrogen Test (Spring 2ft)**

2ND YEAR NUTRIENT CREDITS

3.	(-)		Legume Nitrogen Credit**
4.	(-)		Manure Nitrogen Credit **
5.			**Net Nutrients Needed**

RECOMMENDED NUTRIENT APPLICATIONS

6.	N	P2O5	K2O	Manure Applications – 1st Year Nutrient Credits			
	(pounds per acre)			Source	Timing	Method	Rate
	133	113	103	Bldg 2	Fall	Knife Inject	3800

7.	N	P2O5	K2O	Commercial Fertilizer Applications			
	(pounds per acre)			Form/Analysis	Timing	Method	Rate
	8	24	8	7-21-7	At planting	Row starter 2X2 placement	10 gal.

8.	141	137	111	**Total Nutrients to be Applied**
9.	-9	+97	41	**Nutrient Balance**

[1] Develop a budget for each crop in a normal rotation

[2] Group fields by similar soils, soil fertility and past fertility management.

[3] Use a soil test value that is representative of the grouped fields

Plan developed by: | **TSP I.D. #** | **Date:**

U.S. DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE 03/06

CNMP ROTATIONAL CROP NUTRIENT MANAGEMENT BUDGETS[1]

PRODUCER JOE FARMER | **CROPPING SCENARIO DESCRIPTION** **Soybean/Corn**

Farm # All | **Tract #** All | **Field #s**[2] All

SOIL INFORMATION[3]

	NO_3-N lbs/acre	P ppm	K ppm	Organic Matter %	pH	
1.		>17	122	>3.4	6.2	

CROP NUTRIENT RECOMMENDATIONS

Crop Soybeans	**Previous Year's Crop** Corn	**Crop 2 Years Ago** Soybeans
Realistic Yield Goal 55	**Previous Yields** 170	**Previous Yields** 50

University of Minnesota Fertilizer Recommendations

	N*	P_2O_5	K_2O
	(pounds per acre)		
2.	0	0	0

**Any 1st Year Legume Nitrogen Credits are accounted for in Line 2 Recommendation*

UM Nitrogen Recommendation Used
- ☐ Standard
- ☐ Western MN Soil Nitrate Test (2 ft.)
- ☐ Corn Soil Nitrogen Test (Spring 2ft)**

2ND YEAR NUTRIENT CREDITS

3.	(-)		**Legume Nitrogen Credit****
4.	(-)		**Manure Nitrogen Credit ****
5.			**Net Nutrients Needed**

RECOMMENDED NUTRIENT APPLICATIONS

6. Manure Applications – 1st Year Nutrient Credits

N	P2O5	K2O	Source	Timing	Method	Rate
(pounds per acre)						

7. Commercial Fertilizer Applications

N	P2O5	K2O	Form/Analysis	Timing	Method	Rate
(pounds per acre)						
						.

8.				**Total Nutrients to be Applied**
9.				**Nutrient Balance**

[1] Develop a budget for each crop in a normal rotation

[2] Group fields by similar soils, soil fertility and past fertility management.

[3] Use a soil test value that is representative of the grouped fields

Plan developed by: **TSP I.D. #** **Date:**

Management Practice Considerations for Nitrogen and Phosphorus

Nitrogen Best Management Practices for Southeastern Minnesota

- Adjust nitrogen rate according to soil organic matter content, previous crop and manure applications
- Use a soil nitrate test where appropriate
- Use prudent manure management to optimize nitrogen credit

1. Injection of manure is preferable, especially on strongly sloping soils
2. Avoid manure application to sloping, frozen soils
3. Incorporate manure applications whenever possible

- Plan nitrogen application timing to achieve high efficiency of nitrogen use

1. Do not apply fertilizer nitrogen in the fall
2. Spring preplant application of anhydrous ammonia or urea is encouraged. Broadcast urea should be incorporated within three days of application
3. Apply sidedress applications to corn before it is 12 inches high
4. Inject or incorporate sidedress applications of urea and UAN to a minimum depth of 4 inches
5. Use a nitrification inhibitor with preplant nitrogen applications if soils are poorly drained and soil moisture levels are high near the surface
6. Minimize direct movement of surface-water runoff to sinkholes

Phosphorus Management Practices

- When possible apply manure at rates which satisfy crop phosphorus needs (recommended University of Minnesota rates or crop P removal) instead of crop nitrogen needs on fields testing high in phosphorus. This will prevent long-term buildup.
- Subsurface band or row apply commercial phosphorous fertilizer
- Immediately incorporate broadcast commercial fertilizer
- Control soil losses and runoff to levels considered safe for the soil resource; control to lower levels when fields have very high to excessive soil test phosphorus levels

1. Control sheet and rill losses by installing conservation practices including conservation tillage, contour farming, strip cropping, terraces and cover crops
2. Control ephemeral erosion by installing water and sediment control basins, waterways and diversions

Additional Manure Application Considerations

- Use a cover crop for summer applied manure to fallow ground or early harvested crops (Required by MPCA rules)
- Apply manure to:
  1. All available acres
  2. Land that is the furthest from surface waters
  3. The flattest ground
  4. Fields with the least amount of runoff and erosion
  5. Fields testing lowest in phosphorus
- Avoid manure applications when precipitation causing runoff is likely within 24 hours
- Inject or incorporate manure applications within 24 hours
- Eliminate applications when ground is frozen, snow covered or actively thawing
- Consider agronomic, nutritional and managerial practices which reduce the amount of nitrogen and phosphorous excreted by animals including:
  1. Using high quality protein sources
  2. Feeding low protein, amino acid supplemented diets
  3. Avoiding excessive overages of dietary P
  4. Balancing diets on an available P basis
  5. Using feed ingredients that possess highly available P
  6. Using enzyme additives such as phytase to improve ability to utilize P in rations

Manure Storage, Handling & Testing

Manure & Crop Nutrient Calculator

January 29, 2002

Joe Farmer

Building 1

Livestock Information

Grow-finish pig	800 @ 165 lbs.

Manure Storage

Storage	Underfloor liquid storage
Capacity	350000
Storage	270

Application Methods

Handling	Liquid
Commercial Hauler:	No
Spreader Type:	Slurry spreader
Calibrated:	Yes
Calibration	Volume in spreader load
First App Method:	Knife Inject
First App Timing:	Fall (Oct - Dec)
Second App Method:	Broadcast-Inc. 12-96 hrs
Second App Timing:	Spring (Apr - Jun)

Manure Analysis

Sampling Frequency:	Annually
Sampling Method:	From spreader after loading, well agitated
Date Analyzed:	11/2/2001
N (lbs./ton or 1000 gal):	47.2
P2O5 (lbs./ton or 1000 gal):	35.8
K2O (lbs./ton or 1000 gal):	29.9

Annual Manure/Nutrients Generated

Estimated Volume:	1	348480	gallon
Measured Volume:		420000	gallon
Total N (lbs):	2	19824	
Total P2O5 (lbs):	2	15036	
Total K2O (lbs):	2	12558	

Building 2

Livestock Information

Grow-finish pig (wet/dry feeder)	800 @ 165 lbs.

Manure Storage

Storage	Underfloor liquid storage
Capacity	350000
Storage	365

Application Methods

Handling	Liquid
Commercial Hauler:	No
Spreader Type:	Slurry spreader
Calibrated:	Yes
Calibration	Volume in spreader load
First App Method:	Knife Inject
First App Timing:	Fall (Oct - Dec)
Second App Method:	
Second App Timing:	

Manure Analysis

Sampling Frequency:	Annually
Sampling Method:	From spreader after loading, well agitated
Date Analyzed:	
N (lbs./ton or 1000 gal):	
P2O5 (lbs./ton or 1000 gal):	
K2O (lbs./ton or 1000 gal):	

Annual Manure/Nutrients Generated

Estimated Volume:	1	261360	gallon
Measured Volume:			gallon
Total N (lbs):	2	13939	
Total P2O5 (lbs):	2	14375	
Total K2O (lbs):	2	8712	

1. Estimated volume does not include dilution from bedding or water.
2. Total N, P2O5 and K2O from manure after accounting for storage losses.

Operator/Producer **Joe Farmer** **Planning Year** **2002** **Date Printed** **Jan 29, 2002**

Soil Information

Field	Soil Texture	Soil Map Unit and Name	Date Sampled	Organic Matter	pH	Buffer pH	P ppm	K ppm	Other Nutrient	ppm	Soil Nitrate Nitrogen Date Sampled	NO3 lbs/acre	NO3 PPM
Home T558													
1	Loam	1895B Carmi	10/22/99	3.6	6.6		78 (B1)	221					
2	Silty clay loam	252 Marshan	10/22/99	4.1	6.3		23 (B1)	188					
3	Loam	39B Wadena	10/22/99	3.7	6.5		17 (B1)	148					
4	Loam	1895B Carmi	10/12/00	3.4	6.6		82 (B1)	206					
5	Loam	129 Cylinder	10/12/00	3.8	6.4		17 (B1)	121					
6	Silty clay loam	252 Marshan	10/12/00	4.2	6.3		14 (B1)	108					
7	Loam	39B Wadena	10/18/01	3.2	6.8		19 (B1)	126					
Raddle T978													
East 47	Loam	1896B Ostr-Ca	10/22/01	3.4	6.2		17 (B1)	122					
NE 17	Loam	1896B Ostr-Ca	10/22/01	3.6	6.2		14 (B1)	119					
South 36	Loam	2C Ostrander	10/22/01	3.5	6.4		23 (B1)	147					
West 38	Loam	1896B Ostr-Ca	10/22/01	3.7	6.2		19 (B1)	141					
Ricke T1157													
North 40	Sandy loam	41B Estherville	10/18/01	2.7	6.1		14 (B1)	112					
South 40	Sandy loam	27B Dickinson	10/18/01	2.5	6.3		17 (B1)	98					

Nutrient Summary

Manure & Crop Nutrient Calculator

January 29, 2002

Name **Joe Farmer** **Address** **Any Street**

Phone **(651) 000-0000** **Any City , MN 55555**

Description Follow-up plan after construction of a new 800 head swine finishing building with 350,000 gallons under-floor liquid manure storage. Livestock operation now consists of two 800 head swine finishing buildings each having 350,000 gallons of storage. Land receiving manure consists of 424 acres planted to 50/50 Corn/Soybean rotation.

Manure Nutrient Supply

Total Nutrients From All Manure Sources After Storage and Handling Losses

	Pounds
Nitrogen (N)	29891
Phosphate (P_2O_5)	23529
Potash (K_2O)	19143

Crop Nutrient Demand

Total Annual Nutrient Demand Based On The Crop Rotation

	Pounds
Nitrogen	62752
Phosphate	20564
Potash	17172

Per Acre Average Nutrient Demand Based On The Crop Rotation

	Pounds per Acre
Nitrogen	148
Phosphate	49
Potash	41

Spreadable Acres Needed To Utilize Manure Nutrients

	Acres
Nitrogen	202
Phosphate	485
Potash	473

Additional Spreadable Acres Required (If Needed)

	Acres
Nitrogen	0
Phosphate	61

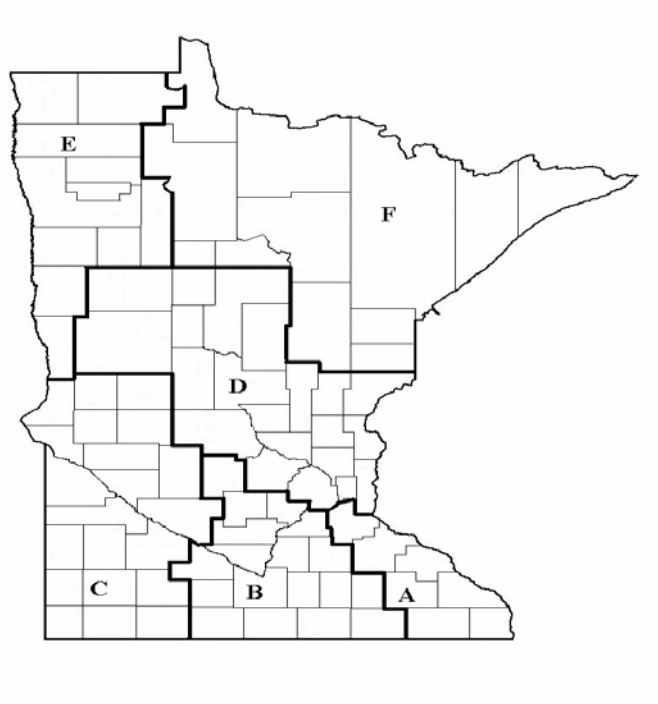
Note:
The rotational average calculations for the “Crop Nutrient Demand” and “Nutrient Summary” reports assume application of manure to both legumes (soybeans in this example plan) and non-legumes (corn in this example). This is generally not a preferred practice, but is used to determine the minimum acres needed to meet state feedlot rules for the operation. Efficient use of nitrogen and prevention of phosphorus buildup in the soil would usually emphasize application of manure to non-legumes only in the rotation. The “Annual Crop Nutrient Plan” section contains the actual field specific manure and fertilizer nutrient rates to be applied.

FIELD NITROGEN LOSS ASSESSMENT

Table 1: Long Term Annual Relative Nitrogen Loss Potential[1]

Zone	Application Method	Soil Texture: Coarse[2]	Medium	Fine
A	Fall	VH	H	M
	Spring preplant	H	M	M
	Sidedress or split	M	L	L
B	Fall	VH	M	M
	Spring preplant	H	L	L
	Sidedress or split[3]	M	L	L
C,D	Fall	VH	L	L
	Spring preplant	H	L	L
	Sidedress or split[3]	M	L	L
E	Fall	M	L	L
	Spring preplant	L	L	L
	Sidedress or split[3]	L	L	L
F	Fall	H	L	L
	Spring preplant	M	L	L
	Sidedress or split[3]	M	L	L

Figure 1: Nitrogen Loss Zones



[1]Potential Rating: VH-Very High, H-High, M-Moderate, L-Low.

[2] Coarse-textured soils apply to the surface soil texture and/or the subsoil texture within three feet of the surface. These textures include sand, loamy sand, loamy coarse sand, fine sand, loamy fine sand, loamy very fine sand, coarse sand, very fine sand, and any of the above listed textures with gravelly or very gravelly modifiers.

[3] If applied after June 15, the loss rating is reduced to Low on Coarse textured soils. However, late nitrogen applications on most soils that are followed by conditions that reduce yield (i.e. below average precipitation) can cause nitrogen loss to occur due to the crop not utilizing the applied nitrogen. To reduce the potential for this to occur on corn ground, apply no later than the 8th leaf stage.

PRODUCER: Joe Farmer **FARM: Home T558, Raddle T978, Ricke T1157**
MAP ZONE OR LOCATION: A

FIELD	APPLICATION METHOD	SOIL TEXTURE	RATING
Home 2	Spring preplant	Medium	Moderate
Home 3	Spring preplant	Medium	Moderate
Home 4	Spring preplant	Medium	Moderate
Home 6	Sidedress or split	Medium	Low
Raddle NE 17	Sidedress or split	Medium	Low
Raddle West 38	Spring preplant	Medium	Moderate
Ricke North 40	Sidedress or split	Coarse	Moderate

When ratings are M or higher select management options from UMES' Regional Nitrogen Best Management Practices. Please note that the management option of most importance in Zone A and on coarse textured soils statewide is eliminating fall application of commercial N fertilizers.

FIELD PHOSPHORUS LOSS ASSESSMENT

Manure applications are not recommended when ephemeral erosion is not controlled.

Distance to Surface Water (feet)	Effective 100 ft. Filter Strip	Soil Test Phosphorous (STP) Levels (ppm)		Sheet and Rill Erosion (Tons/Acre/Year)	**Base Manure Application Rate on:**
		Bray P1	Olsen		
NA	NA	NA	NA	**> 6**	**No Application**
< 300	**No**	≤ 21	≤ 16	< 6	**Nitrogen Needs**
		22 - 75	**17 - 60**	< 6	**P_2O_5 Removal**
		76 - 150	61 - 120	**< 4**	**P_2O_5 Removal**
				4 - 6	**No Application**
		> 150	**>120**	< 6	**No Application**
	Yes	≤ 21	≤ 16	< 6	**Nitrogen Needs**
		22 - 75	17 - 60	< 4	**Nitrogen Needs**
				4 - 6	**P_2O_5 Removal**
		76 - 150	**61 - 120**	< 6	**P_2O_5 Removal**
		> 150	>120	**≤ 2**	**P_2O_5 Removal**
				> 2	**No Application**
≥ 300	**No**	< 76	< 61	< 6	**Nitrogen Needs**
		76 – 150	61 - 120	< 6	**P_2O_5 Removal**
		> 150	> 120	**< 4**	**P_2O_5 Removal**
				> 4	**No Application**
	Yes	≤ 150	≤ 120	< 6	**Nitrogen Needs**
		>150	>120	< 4	**Nitrogen Needs**
				4 – 6	**P_2O_5 Removal**

PRODUCER: Joe Farmer **FARM: Home, T558, Raddle T978, Ricke T1157**

FIELD	DISTANCE TO WATER	FILTER STRIP	STP LEVEL	SOIL LOSSES	RECOMMENDATION
Home1	greater than 300 ft	No	78B ppm	5.5 ton	P2O5 Removal
Home 2	less than 300 ft	No	23B ppm	4 ton	P2O5 Removal
Home3	less than 300 ft	No	17B ppm	4.8 ton	Nitrogen Needs
Home4	less than 300 ft	No	82B ppm	3.9 ton	P2O5 Removal
Home 5	less than 300 ft	No	17B ppm	5 ton	Nitrogen Needs
Home 6	less than 300 ft	No	14B ppm	4 ton	Nitrogen Needs
Home 7	less than 300 ft	No	19B ppm	4 ton	Nitrogen Needs
Raddle E. 47	greater than 300 ft	No	17B ppm	6 ton	Nitrogen Needs
Raddle NE 17	greater than 300 ft	No	14B ppm	6 ton	Nitrogen Needs
Raddle S. 36	greater than 300 ft	No	23B ppm	5 ton	Nitrogen Needs
Raddle W 38	greater than 300 ft	No	19B ppm	6 ton	Nitrogen Needs
Ricke N. 40	greater than 300 ft	No	14B ppm	6 ton	Nitrogen Needs
Ricke S. 40	greater than 300 ft	No	17B ppm	6 ton	Nitrogen Needs

Recordkeeping Forms APPENDIX 4

Manure and Wastewater Storage and Handling Records[1] or analogous NRCS hardcopy or equivalent MPCA Recordkeeping forms[2]	☐	
Fertilizer and Manure Application Records[1] or analogous NRCS hardcopy or equivalent MPCA forms or equivalent[2]	☐	
Crops Production Records[1] or analogous NRCS hardcopy or equivalent[2]	☐	
NRCS Form MN-CPA-046 (Practices Certification Recordkeeping Form) [2]	☐	
Permits or	☐	
Location of permits Producer's files	☒	
[1.] These reports are from "Nutrient Management Planner for Minnesota" software		
[2.] NRCS recordkeeping and certification forms can be found at the following location if you do not want a hard copy at this time : http://www.mn.nrcs.usda.gov/technical/ecs/nutrient/nutrient.html	☒	

Feed Management APPENDIX 5

Evaluation	
NRCS Beef, Dairy or Pig Nutrition Self Assessment Form[1] or analogous NRCS hard copy.	☒
	☐
	☐
	☐
	☐
	☐
NRCS Fact Sheets	
Effects of Diet and Feeding Management on Nutrient Content of Manure[2]	☐
Feed and Animal Management for Dairy Cattle	☐
Feed and Animal Management for Poultry	☒
Feed and Animal Management for Swine	☐
Feed and Animal Management for Beef	☐
1 This report is from "Nutrient Management Planner for Minnesota" software	
2. This fact sheet is located at the following site if you do not want hard copy at this time: **http://www.mn.nrcs.usda.gov/technical/ecs/nutrient/nutrient.html**	☒

Pig nutrition self-assessment

Feeding Practices	Reduces N Content of Manure	Reduces P Content of Manure	Reduces Air Quality Effects	Do you currently practice?	Will you consider for future?
· install feeders/feed systems designed to minimize feed waste	x	x		**Yes No**	**Yes No**
· adjust and clean feeders frequently	x	x		**Yes No**	**Yes No**
· use pelleted feeds	x	x	x	**Yes No**	**Yes No**
· formulate feeds based on digestible nutrients rather than totals	x	x	x	**Yes No**	**Yes No**
· select feed ingredients that have high digestibility	x	x	x	**Yes No**	**Yes No**
· grind coarse feed ingredients to a uniformly fine particle size	x	x		**Yes No**	**Yes No**
· add phytase to the feed		x		**Yes No**	**Yes No**
· add fiber-degrading enzymes to the feed	x		x	**Yes No**	**Yes No**
· select ingredients that are low in fiber (NDF and ADF)	x	x	x	**Yes No**	**Yes No**
· select ingredients that are low in trypsin inhibitors	x			**Yes No**	**Yes No**
· include disposal costs in economics of nutrition decisions	x	x	x	**Yes No**	**Yes No**
· implement phase feeding and split-sex feeding	x	x	x	**Yes No**	**Yes No**
· determine the nutritional value of each batch of an ingredient	x	x	x	**Yes No**	**Yes No**
· properly weigh and mix ingredients	x	x		**Yes No**	**Yes No**
· reduce protein in the diet by matching amino acid requirements	x		x	**Yes No**	**Yes No**
· add urine-acidifying compounds to the feed			x	**Yes No**	**Yes No**
· avoid excess sulfur-containing mineral sources			x	**Yes No**	**Yes No**
· use efficient water nipples, cups under drinkers, wet-dry, or liquid feeders and fix water leaks immediately			x	**Yes No**	**Yes No**

Modified from Livestock and Poultry Environmental Stewardship Program, Lesson 10, Reducing Pig Waste and Odor Through Nutritional Means; Theo van Kempen

USDA United States Department of Agriculture

NRCS Natural Resources Conservation Service

Ecological Sciences Divison

October 2003

Feed and Animal Management for Swine
(Growing and Finishing Pigs)

Introduction

Swine operations may include a complete farrow to finishing unit, or various combinations of separate units for feeder pig production, including nursery units, grower-finishing pigs, or the breeding herd. Each stage of the life cycle requires distinctly different diets, resulting in great differences in the volume and nutrient composition of the manure produced.

This technical note briefly highlights some factors affecting nutrient excretion. These factors include potential dietary adjustments that can be used to minimize excess nutrient excretion from growing-finishing pigs.

Selected nutrient requirements for pigs of different sizes, as listed in the National Research Council's (NRC) publication *Nutrient Requirements of Swine* (10th revised edition, 1998), are given in table 1. Reference to these guidelines is important for a thorough evaluation of all swine diets, including the breeding herd, on a commercial operation.

Table 1 Selected nutrient requirements for grower-finisher pigs [1]

Nutrient (% or unit/kg of diet, 90% dry matter)	Pig wt. 7–11 lb	Pig wt. 11–22 lb	Pig wt. 22–44 lb	Pig wt. 44–110 lb	Pig wt. 110–175 lb	Pig wt. 176–265 lb
Crude Protein, %	26.00	23.70	20.90	18.00	15.50	13.20
Lysine, %	1.50	1.35	1.15	0.95	0.75	0.60
Lysine, % true ileal dig.	1.34	1.19	1.01	0.83	0.66	0.52
Calcium, %	0.90	0.80	0.70	0.60	0.50	0.45
Phosphorus, % total	0.70	0.65	0.60	0.50	0.45	0.40
Phosphorus, % available	0.55	0.40	0.32	0.23	0.19	0.15
Potassium, %	0.30	0.28	0.26	0.23	0.19	0.17
Sodium, %	0.25	0.20	0.15	0.10	0.10	0.10
Copper, mg/kg	6.00	6.00	6.00	4.00	3.50	3.00
Zinc, mg/kg	100.00	100.00	80.00	60.00	50.00	50.00

1 Adapted from tables 10–1 and 10–5 in *Nutrient Requirements of Swine*, revised edition, 1998, National Research Council (NRC), National Academy of Sciences, National Academy Press, 2101 Constitution Avenue, Washington, DC 20148 (G.L. Cromwell, chair, Subcommittee on Swine Nutrition).

This is the third in a series of nutrient management technical notes on feeding management.

Series was prepared by **Dr. Alan Sutton,** professor of Animal Science at Purdue University, West Lafayette, Indiana, and **Charles H. Lander,** national agronomist, NRCS, Washington, DC. This series was developed from material published by the Federation of Animal Science Societies (FASS), Savoy, Illinois.

Diet formulation

Feeding diets that are higher in crude protein or phosphorus (P) than required by swine result in manure with more concentrated N and P. Producers should feed diets that meet the requirements of their animals without having excess overages.

Phase feeding. Dividing the growth period of the pigs into several periods with a small spread in body weight allows producers to provide diets that more closely meet the pig's nutrient requirements. Feeding three or four diets during the grow-finish (G-F) period, compared with feeding only two diets during this period, would reduce N and P excretion by at least 5 to 10 percent.

Split-sex feeding. Gilts require more protein and amino acids than barrows. Penning barrows separate from gilts allows the feeding of lower protein and amino acid levels to barrows without compromising the growth and performance efficiency of gilts. It also reduces nutrient waste, and can reduce N excretion by at least 5 to 10 percent.

Formulate diets on an available nutrient basis. A high proportion (55-80%) of the P in cereal grains and oilseed meals occurs as phytate. Phosphorus in this form is not well utilized by pigs because they lack sufficient intestinal phytase, the enzyme needed to remove the phosphate from the phytate molecule. Therefore, supplemental P is added to the diet to meet the pig's phosphorus requirements for growth and bone formation. The indigestible phytate P and any excess P in the diet are excreted in the feces.

Supplementing the diet with the enzyme phytase is one of the most effective means of increasing the breakdown of phytate P in the digestive tract and reducing P excreted in the feces. Using phytase allows a lower level of supplemental inorganic P in the diet because a portion (35%) of the unavailable phytate P in the grains is released and made available by the phytase enzyme to help meet the pig's P needs. Inclusion of phytase increases the availability of P in a corn-soy diet by threefold, from approximately 15 percent up to 45 percent, and results in reduced P excretion of 20 to 30 percent.

Because some feedstuffs are high in phytate and because there is some endogenous phytase in certain small grains (wheat, rye, triticale, barley), the bioavailability of P in feed ingredients varies widely. For example, the P in corn is only 12 to 15 percent available, while the P in wheat is 50 percent available. The P in dehulled soybean meal is more available than the P in cottonseed meal (23% vs. 1%), but neither source of P is as highly available as the P in meat and bonemeal (90%), fishmeal (93%), or dicalcium phosphate (95%). To reduce excretion levels, diets should be formulated on an available P basis according to NRC (1998) recommendations, making any adjustments needed for farm-specific pig performance.

Some feed manufacturers formulate swine feeds on an **ideal protein** basis. An ideal protein is one in which the amino acids closely match the animal's requirements for lean tissue protein synthesis and maintenance. One way of doing this is to reduce the crude protein level in the diet and supplement with synthetic amino acids. Although nutritionists cannot prepare perfect amino acid balances from natural feed ingredients, using computers and an array of many different ingredients and synthetic amino acids allows them to produce feeds that have reduced amino acid excesses. Reducing the crude protein in the diet by 3 to 4 percent and supplementing with synthetic amino acids (generally, lysine, methionine, threonine, and tryptophan) have shown a 20 to 40 percent reduction in N excretion.

Feed management

Controlling feed wastage improves herd feed conversion and reduces nutrient losses. Feed wasted in the manure pit can add considerably to the nutrients that need to be applied to the land. Check and adjust feeders often to reduce wastage.

Wet-dry feeding systems can significantly reduce feed and water wastage. Some research has shown that manure volume per pig was reduced by 30 to 50 percent by using wet-dry feeding systems. However, the nutrient concentrations in the manure from a wet-dry feeding system generally are significantly higher. Therefore, routine manure analyses are needed to adjust application rates of such manure to cropland.

The mineral content of the water supply should be considered with regard to the total intake of dietary minerals. Depending on the quality of the water supply available, water intake may make a substantial contribution to daily mineral intake, particularly with regard to sulfur and, in some areas of the country, salt. Routine water sampling can help the nutritionist formulate properly for the amount of minerals that need to be added to the diet to meet the animal's actual requirements.

Maintaining pigs under comfortable environmental temperature and humidity conditions improves feed utilization and can reduce nutrient excretion. Cold temperatures increase caloric requirements for body maintenance, and, therefore, increase feed intake and nutrient excretion. Likewise, extremely hot temperatures reduce feed intake, decrease growth rate, and increase time to market, thereby ultimately increasing nutrient excretion.

Raising genetically lean pigs (rather than fat ones), controlling diseases and parasites, and using good management practices are further examples of how one can improve feed conversion efficiency and reduce nutrient excretion.

Fine grinding (600 to 700 microns is most desirable) and pelleting feed are also effective ways in improving feed utilization and decreasing dry matter manure volume. Dry matter manure volume may be reduced by 15 percent, and nutrient excretion, especially N, by about 5 percent. By reducing the particle size, the surface area of the grain particles is increased, allowing greater interaction with digestive enzymes. Addition of enzymes, such as phytase, amylase, protease, and glucanase, may release nutrients that will enhance nutrient retention and reduce excretion. This is especially true in corn-soybean meal diets.

Summary

The National Research Council's *Nutrient Requirements for Swine*, 1998 edition, is a key reference to evaluate all swine diets, including the breeding herd, on a commercial operation.

Also, consult qualified nutritionists to accurately evaluate current or planned diet compositions during the development of conservation plans, particularly Comprehensive Nutrient Management Plans (CNMPs).

Using multiple strategies in the formulation of swine diets and techniques to improve feed use efficiency can significantly reduce the nutrient content of excreted manure. The potential for these strategies to impact manure nutrient content is shown in table 2.

The actual impact of a feed management strategy or strategies on a swine operation can only be determined by analysis of the manure after the strategy has been implemented. During the development of CNMPs, the potential impact of a strategy or strategies can be estimated using the values in table 2. In using data from this table, planners are encouraged to be conservative in their selection of factors. Also, it is important to remember that the impact of using multiple strategies in a single diet is not likely to be additive for each single strategy being used. Rather, it is more likely to be something greater that the value for the strategy with the smallest impact, but less than the sum of values for all the individual strategies being used.

During the development of CNMPs, it is better to underestimate the potential impact of feed management than to overestimate it. Later, the plan can be modified based upon data accumulated from the actual production operation.

Table 2 Potential for feed management to impact the nutrient content of swine manure [1]

Strategy	Nitrogen reduction %	Phosphorus reduction %
Formulate diet closer to requirement	10–15	10–15
Reduced protein/AA supplementation	20–40	n/a [2]
Use highly digestible feeds	5	5
Phytase/low phosphorus diet	2–5	20–30
Selected enzymes	2–5	5
Growth promotants	5	5
Phase feeding	5–10	5–10
Split-sex feeding	5–8	n/a [2]

[1] Adapted from the Federation of Animal Science Societies (FASS) publication, *Dietary Adjustments to Minimize Nutrient Excretion from Livestock and Poultry,* January 2001.

[2] Not applicable.

Glossary

Available nutrient basis. Formulating a diet based on the bioavailability of the nutrients from the feed ingredients in the diet for the intended production purposes.

Bioavailability of nutrients. The amount of nutrient in the diet that is released in the digestion process and that can be absorbed in a form that can be used in the body for normal metabolic functions of the nutrient.

Crude protein, A measure of dietary protein that is based on the assumption that the average amino acid in a protein contains 16 percent nitrogen. Thus, total chemically determined nitrogen × 6.25 (100 ÷ 16) = crude protein.

Diet formulation. The process of combining an assortment of feed ingredients into a diet that will meet the nutrient and energy requirements of the animal for the intended purpose for which the animal is produced.

Digestibility. The relative amount of nutrients released from the digestion process.

Endogenous. Nutrients within the animal that may be produced or synthesized. Excretion of endogenous nutrients may occur from the recycling of nutrients and normal cellular metabolic processes.

Endogenous phytase. The enzyme naturally derived within the animal or from microbial sources within the animal that degrades phytate and releases phosphorus.

Ideal protein basis. Formulation of a diet based on the concept that the protein content of the diet has a balance of amino acids that exactly meet an animal's amino acid requirements.

Phase feeding. Changing the nutrient concentrations in a series of diets formulated to meet an animal's nutrient requirements more precisely at a particular stage of growth or production.

Phytase. An enzyme that degrades phytate, making phosphorus available to nonruminants.

Phytate phosphorus. A complex, organic form of phosphorus that is bound to the phytate molecule and is not readily digested by nonruminant animals.

Split sex feeding. A feeding and housing program that divides animals by gender and formulates diets to meet the specific nutrient requirements of each sex more precisely.

Wet-dry feeding systems. Feeding systems designed to introduce water with dry feeds either at prescribed periods or on demand by the animal. Introducing water at the time of feeding also reduces the potential for water spillage and dust from feed sources.

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Fact Sheets and Guidesheets APPENDIX 6

NRCS Fact Sheet MN-NUTR-3 ("Soil Sampling")[1]	☐
NRCS Fact Sheet MN-NUTR-6 ("Manure Sampling and Analysis")[1]	☐
University of Minn. Extension Service Fact Sheet "Calibrating Manure Spreaders"[1]	☐

[1]These fact sheets can be found at the following web-site if you do not want a hard copy at this time: http://www.mn.nrcs.usda.gov/technical/ecs/nutrient/nutrient.html ☒

SOIL SAMPLING

Economic fertilizer recommendations should be developed based on analysis of properly sampled soil. This fact sheet focuses on soil sampling and soil testing laboratories.

Soil Sampling Procedures

Soil test results are no better than the samples collected. Proper soil sampling techniques are critical to determine the average nutrient status in a field as well as the nutrient variability across a field. Fertilizer recommendations based on samples not representative of a field may result in over-application and/or under-application of nutrients. This can have a negative impact on both economics and the environment.

The Natural Resources Conservation Service (NRCS) requires producers to test their soil every 4 years. These analyses will include pH, organic matter, phosphorous and potassium. Producers are also encouraged to test for soil nitrate levels, when applicable.

The first step is to determine the number of samples needed per field. This is dependent upon the amount of variability within the field. Factors that should be considered include soil types and textures, slopes, cropping history, manure history, drainage, and erosion. Each sample is comprised of 15-20 cores. A core is an individual boring or coring at one spot in the field.

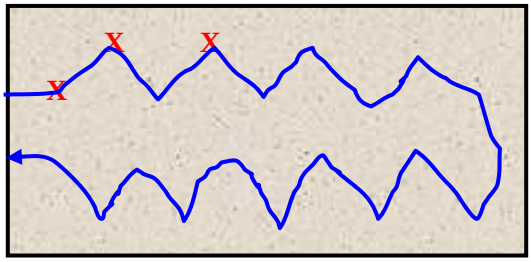
Ideally, large uniform fields should have 1 composite sample collected per 20 acres or less. Smaller fields, including contour strips, should have 1 composite sample collected per 5 acres, especially on hilly or rolling ground. Separate samples should be taken from unique areas such as low spots, eroded knolls, terraces, old fence rows, lime or fertilizer spill areas, headlands and saline areas.

Fewer samples can be taken provided there is little in-field variability; the number of cores representing an individual sample is increased; or fertility management of small individual areas is not practical. In these cases, samples from larger fields and uniform landscapes may be divided into areas that are no larger than 40 acres. Smaller fields and hilly or rolling ground should be divided into uniform areas that are no larger than 20 acres.

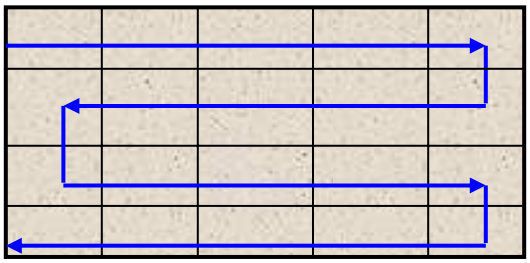
Once you have defined your sampling areas, mark them on a map before you begin. Label them with a unique name or number. You may also want to mark the corresponding sample containers before heading into the field.

The next step is to properly collect the samples. Most samples should be collected after harvest. Do not sample shortly after lime, fertilizer or manure applications. Using a soil probe, soil auger or spade, collect 15-20 cores at random or in a grid pattern, making sure that the sampling area is adequately represented. Be sure to scrape any crop residue and manure off of the soil surface.

Samples collected randomly



Samples collected in a grid pattern



The cores should be collected from between the rows of row crops, except for ridge-till plantings. In a conventional tillage system, samples should be collected from the surface layer to a depth of 6 inches for all nutrients except nitrogen.

Where ridge till is used, collect core 6 inches to the side of banded fertilizer applications. In reduced and no-tillage systems, the depth sampled has a much greater impact on the soil test results because of the stratification of non-mobile nutrients and pH. Surface samples (0-6 inch) may need to be separated into 0-2 and 2-6 inch depths.

Mix cores thoroughly in a clean plastic pail to obtain an individual composite sample. Fill sample boxes or bags provided by soil labs from the pail to the fill line. A 60 -acre field with 3 sampling areas would require 15-20 cores for each of 3 composite boxed or bagged samples. All samples should be kept cool until delivered to the soil-testing lab.

Obtain and complete a laboratory soil sample information sheet before submitting samples. Typically you will be asked for sample identification information, crops to be grown, yield goals, previous crops and the tests you want conducted. Make sure the completed information is consistent with your maps and sample bags or boxes and that sample depths are also noted.

Samples for nitrate-nitrogen should be collected to a depth of 24 inches. Nitrate-nitrogen samples can be collected in Western and Northwestern Minnesota in fall (preferably after Sept. 15) or in early spring. Collect nitrate-nitrogen samples in South-Central, Southeastern and East-Central Minnesota before planting, at planting, or immediately after planting corn. Nitrate-nitrogen samples should be kept cool and shipped immediately overnight to the lab or immediately frozen and sent via normal mail. In either case, ensure that the sample does not arrive at a lab on a Saturday or Sunday.

Soil Test Laboratories

For NRCS program participants, samples should only be submitted for analysis to a laboratory that participates in the Minnesota Department of Agriculture (MDA) Soil Testing Lab Certification program. A list of certified laboratories is available on-line at: http://www.mda.state.mn.us/ by going to “MDA A to Z” and clicking on “S” and then “Soil Testing Laboratories”.

Labs that participate in this program do so to ensure that their analytical methods have been collectively endorsed by midwestern universities. This significantly reduces variability from lab to lab. These labs also use the same reporting units as are used in University of Minnesota Fertilizer Recommendations such as parts per million of elemental Phosphorous (P). This reduces the risk of error that could result from developing fertilizer recommendations based on different reporting units or using different analytical procedures.

Some soil testing laboratories participating in MDA’s certification program may also provide crop nutrient need recommendations. These recommendations may be different than current University of Minnesota Fertilizer Recommendations. It is important to recognize and understand these differences.

MANURE SAMPLING AND ANALYSIS

This fact sheet was prepared by Jan Jarman, formerly with the Mn. Dept. of Agriculture.

Manure nutrients applied to cropland should be accounted for when determining commercial fertilizer needs. Manure nutrient composition varies widely between farms due to differences in animal species and management and manure storage and handling. Sampling and laboratory analysis is the only method for determining the actual nutrient content of manure. Published average values should only be used for initial application rate planning when no previous analyses are available, for estimating total nutrients generated in a specific time period, or for MPCA permitting requirements.

WHEN TO SAMPLE

Manure is very heterogeneous and nutrients stratify in storage. Sample manure at application time following adequate agitation of liquids in storage or mixing of solids in the spreader loading process. If no previous analyses are available, use published average values for initial application rate planning, then use the analysis results to calculate commercial fertilizer needs. Sample manure each time it is applied, over the course of several applications. Track analysis results to determine the needed sampling frequency and develop farm-specific average value to use for application rate planning. Nutrient content will change with changes in management (housing, feed, bedding, storage, handling) and can vary between years or seasons depending on precipitation (for manure stored outdoors).

WHAT TO SAMPLE

Agitated liquid slurries: Agitate liquid in entire structure for 2-4 hours just prior to application. Take one sample per 300,000 gallons of pumped manure. Avoid sampling near beginning and end of pump-out. Each sample may consist of several subsamples mixed together. If it is not possible to agitate liquid slurries before application, several samples taken throughout pump-out will be needed to characterize the manure. Keep track of which sample results correspond to manure applied to which fields.

Unagitated lagoon liquids (single/multiple stage, settling basins): Lagoons, which act as settling basins or are used in flush/recycle systems, are usually not agitated. Take out sample per 300,000 gallons of pumped liquid. Avoid sampling near beginning and end of pump-out. Each sample may consist of several subsamples mixed together.

Stored solids: Depending on the size of the pack, pile or stack, take at least three samples during application, each consisting of 5-10 subsamples from different loads. More samples are needed for stored solids because of its extreme variability. Avoid sampling the outside foot of a pile or stack.

Scrape and haul: Sample when applying to fields where nutrients will be credited. Fall is probably the most important time to sample. Take several subsamples from consecutive applications and mix together. Samples may be taken throughout the year to characterize variability.

Poultry in-house systems: For litter or manure that is not stored for any length of time prior to application. Use a pitchfork or shovel to sample to the depth of the floor in 5-10 locations in each house. Mix subsamples to obtain 1 or 2 samples for analysis. Take subsamples from around feeders and waterers in proportion to the areas they occupy.

HOW TO SAMPLE

Liquid manure: Samples can be taken in the field (for broadcast manure) or from the application equipment. Sampling in the field can be done by placing catch cans throughout the area where manure will be spread. Mix the subsamples in a bucket and take a smaller sample for analysis. Sampling from the application equipment is the easiest and most effective way to get a good sample. Take subsamples from the filling hose or from a bottom unloading port, mix together in a bucket and take a sample for analysis. Sampling from liquid storage structures is not recommended since it is much safer and easier to sample from application equipment or in the field.

Solid manure: Samples can be taken in the field or from the spreader. In the field, spread tarps to catch manure as it is applied. For each sample, take several small subsamples from the tarps and place in a bucket or pile. Avoid larger pieces or chunks of bedding. Collect other subsamples throughout application and keep cool. Subsamples can be mixed by placing in a pile and repeatedly shoveling the outside of the pile to the inside. Use a trowel or plastic gloves to take a smaller sample for analysis. Samples can also be taken with a pitchfork or shovel from the spreader box after it is loaded. Collect subsamples throughout application, keep cool, mix and take a smaller sample for analysis. Again, sampling from the field or spreader is much easier and safer than trying to sample from a pack or pile.

SAMPLE HANDLING AND ANALYSIS

Laboratories: A listing of manure testing laboratories is available from the Minnesota Department of Agriculture Manure Testing Laboratory Certification Program, (612) 297-2530.

Preparing samples: For liquids and solids, clean, leakproof plastic jars with wide mouths may be used for the samples. Solids with lower water content can also be placed in leakproof plastic ziplock bags. Most laboratories will provide sample jars and postpaid mailing packages. Jars should be filled no more than 2/3 – ¾ full, tightly sealed and placed in a leakproof plastic bag. For solids, plastic bags can be partially filled and all the air squeezed out. Fill the sample container with about 1-2 cups or 1-2 pounds (a large handful) of manure for analysis. Tightly seal containers and label with the farmer's last name and a sample ID using a waterproof marker. Place in a second plastic bag and freeze overnight if possible. Do not let samples sit in the sun or at room temperature for more than 12 hours. Mail samples early in the week and avoid weekends and holidays. Be sure to include payment and the sample information sheet.

Analyses: Analyses needed for developing a manure application plan are total nitrogen (N), phosphate (P_2O_5) and potash (K_2O). Laboratories usually provide these analyses plus dry matter (solids) and sometimes ammonium-N (NH_4-N) for a set fee. Knowing NH_4-N can be useful if this fraction makes up a large percentage of the total N in the manure. All of the NH_4-N is usually available the first year of application. If this fraction is high (70% or more of total N), then total N availability the first year may be higher than average. It is usually not necessary to analyze manure for other mineral constituents such as calcium, magnesium, zinc, sulfur or boron. Most manures contain significant quantities of these minerals, and fields with manure histories are rarely deficient.

Results: Manure nutrient content should be reported in units of lbs/ton or lbs/1000 gallons, on an as-is basis. Phosphate and potash should be reported as such, rather than as P and K. A table of conversion factors is given below. Always check results to make sure they fall within normal ranges for that particular species and storage system. Use University of Minnesota nutrient availability factors to calculate total available nutrients applied.

CONVERSION FACTORS

To convert Column 1 into Column 2, multiply by	Column 1	Column 2	To convert Column 2 into Column 1, multiply by
10,000	percent (%)	parts per million (ppm)	0.0001
% DM / 100	%, DM basis	%, as-is basis	100 / % DM
83.3	%, as-is basis	lbs/1000 gal	0.012
20	%, as-is basis	lbs/ton	0.05
2.29	P, any unit	P_2O_5, any unit	0.44
1.2	K, any unit	K_2O, any unit	0.83